JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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EDITORIAL NOTES—GAS, &c.

Belated but Agreeable.

WITH all their resources and power, the Board of Trade are extraordinarily dilatory in their production of statistical returns. The statements relating to statutorily controlled gas undertakings are ever so belated that what would otherwise be their manifold value is reduced merely to that attaching to consecutive and official records of the progress of the industry. It is now a year and seven months since the returns relating to gas undertakings for (in the case of companies) 1905 and (in the case of local authorities) 1905-6 were issued; and last week, at length, were published those for 1906 and 1906-7 respectively for the two classes of ownership. There was a reason advanced for the delay on this occasion; and it was that a rearrangement of the returns had been taken in hand. Now that the documents are before us, and the extent of the reorganization is seen, we say emphatically that it offers no substantial vindication for the extraordinary delay that has taken place. We know the difficulties of collecting returns; but making due and full allowance for these, the leisurely fashion, under ordinary circumstances, in which the returns are produced is a reproach to the Board, and would be deemed a disgrace by any reputable private firm of compilers and publishers. But these latest returns, giving us statistics that have long since been passed by a further complete year's working of the gas undertakings, intensifies a long-harboured belief that the machinery employed in their production requires speeding-up somewhat, and a time-limit put upon its work, so that the product may be more worthy of a Government department, and bring to it *kudos* rather than derision.

The returns convey the aggregate information that was anticipated from a study of the results of the trading of gas companies in 1906 and of gas authorities in 1906-7. There is concentrated in the statistics the confirmation of the universal progress of the British gas industry, or of that major part that is working under statutory authority. The data relate to 763 gas undertakings; the increase upon the preceding year being only eleven. The additions represent simply small concerns; so that they do not contribute very materially to the larger figures, recording progress, with which we have again to deal on this occasion. In view of the economical proclivity of the incandescent burner in lighting, the extension of business portrayed by the statistics shows a broadening of the base of the industry that is highly agreeable to contemplate. A few figures calculated from those in the returns (as reproduced elsewhere in this issue) will serve to indicate this. The total receipts of the 763 undertakings in the financial year were £28,009,330—being an increase of £755,625; while the total expenditure of £20,883,356 represented an increase of £387,339. Having regard to the relation of the total receipts to the total expenditure, the extra receipts, it will be remarked, were earned on a much reduced additional expenditure. The total quantity of coal carbonized was 14,846,257 tons; the increase being 365,932 tons. The total make of gas was 181,841,076,000 cubic feet, of which 167,945,206,000 cubic feet were sold. But the total output represents a growth of 6,936,285,000 cubic feet, which is an emblazoned sign that the process of dissolution in the industry has not yet commenced, but, on the contrary, that substance is still being added to substance. The proportions of coal gas to water gas manufactured can be seen in the statistics on other pages. The numbers of consumers bear similar testimony. The total of 5,363,533 represents a growth of 299,458; while the number of public lamps supplied—677,980—tells an increase of 12,189. That the advantages of gas continue to penetrate new regions is observed by the fact that the distributing mains at the close of the year measured 32,690 miles; being an increase of 1759 miles. All this is very satisfactory; but we cannot excuse the inertia that has kept the information hidden so long in the offices of the Board of Trade. To regain even the former position—backward though it was—another set of returns should be in our hands next January.

Financial Reflections.

AN analysis of the accounts of eight Gas Companies supplying in the Metropolis and suburbs has been published in the "Joint-Stock Companies' Journal;" and from the average figures our contemporary has drawn certain deductions. These deductions are interesting and highly complimentary; but it is questionable whether there is any great value in averages of the kind, save as a rough index to the movements of the industry as a whole. In the tabular work presented by our contemporary, the separate data for each Company are given; but in the forepart of its editorial comments, the averages of the whole are taken. They induce reflection. For instance, the items of revenue and disbursement in such a business as gas supply suffer distinct variation through geographical and topographical influences. Even London and the suburbs are anything but homogeneous in their characteristics; and the distinctive features have their individual bearing upon the fortunes of the Gas Companies. London is the chief mart of the universe; and the centre of attraction for shopping by the public. The permanent residents in considerable areas form the extremities of the social scale. The environs absorb the middle classes, and in some districts multitudes of London's workers. Situated in certain of the environing areas are large manufactories; in others there are few, and, in cases, of small magnitude and scattered. These suburbs have their rises and their falls. Some have been of late years growing at a rate that cannot be maintained for many years. Building has proceeded apace, rents are fairly low, and cheap travelling facilities have been afforded; and these considerations cause migration and settlement to the advantage of local prosperity, and, in a measure, to the disadvantage of older districts by the exodus to the newer ones. But there is no concrete permanence about this sort of thing. The pendulum swings to and fro—perhaps too slowly for the satisfaction of those who are for the time being irremovably situated for business purposes in districts that are undergoing temporary depression, and to which empty property bears ill-favoured witness. But these propitious and unpropitious features, the definition of which becomes increasingly marked, must conduce to more active competition between locality and locality. It is indeed imperative that local authorities and property owners should bend their attention more and more towards making their areas attractive—particularly by lightening the burdens on the over taxed and rated householder; and, if they do this, it will surely be found, especially in the districts suffering present depression, that the big distinctions between locality and locality that exist to-day will in time be outlined with less intensity. When the existing diversified conditions are considered, and it is remembered how much the current prosperity of different gas companies is bound up with those conditions, it is at once impressed upon notice of how little value is the law of averages in their case, and how wanting in real usefulness are comparisons of final figures between company and company.

The Companies whose accounts for the first half of each of the past three years are analyzed by the "Joint Stock Com-"panies' Journal" are the Brentford, Commercial, Croydon, Gaslight and Coke, South Metropolitan, South Suburban, Tottenham and Edmonton, and West Ham—all trading in districts with nothing in common in condition. However, taking the accounts together, and extracting their lessons, one point that particularly strikes our contemporary is the consideration that has been given by the Companies to the consumers through the recent trying period, during which the price of coal has been exceptionally high; and we would add that the prompt manner in which the Companies who are

in a position to do so have announced, with the decline in coal prices (inadequate though it has been), reductions in gas prices, or reversions to former prices, is also a matter that should be recognized. The analysis and the averages, together with this fact as to prices, mirrors the robustness of the industry. There are some folk who deplored the slight decrease in consumption of gas that four of the Companies named incurred during the past half year in comparison with the similar period of 1907; but when the figures are placed alongside those of but the corresponding period of 1906, it is seen that the past half-year's consumption shows a very material advance. The other four Companies, with their developing areas, have followed the progressive line without break, at varying briskness of pace—the rate of briskness being entirely regulated by local conditions, and the opportunities for additional business. This must be, because all other conditions (excepting, of course, that of lethargy in stimulating business) that depress or increase gas consumption have general application. In the result, however, there is much satisfaction in seeing that, though the past half year, taking the eight Companies in a body, only contributed 24,686,000 cubic feet increase upon the total sale to private consumers in the first half of last year, the consumption of the past half year stands at 928,180,000 cubic feet higher than it did in the first half of 1906. And this notwithstanding the competition of electricity and the accruing economy of the incandescent burner! There is indeed much gratification derivable from this state of affairs.

While speaking of the increase in the volume of output, our financial contemporary lays stress upon the extension of the sales volume being at the back of the ability of the Companies to reduce their charges. Having regard to the figures that appear in the analysis, it would be a poor compliment to administrative and executive endeavour if this factor were allowed to remain magnified and others ignored. Look, for example, at the manufacturing charges other than material. Last half year there was under this head —still taking the eight Companies—an average of 1d. decrease per 1000 cubic feet of gas sold compared with the first half of 1906, or ½d. for each half year. Then, again, the aggregate capital of the Companies in relation to their total consumption exhibits between last half year and the corresponding period of 1906, a recession by 6·4d. per 1000 cubic feet; and this means a reduction of the interest and dividend charges per 1000 cubic feet of gas sold. Reduction of the average capital is not alone due to expansion of the volume of sales; but something has to be credited to improvement in production per ton of coal and per unit of plant provided. This being so, the honour of reduced prices to the consumers has to be distributed between their larger patronage and the manufacturing advancement. The cost of raw material, and the prices ruling in the residuals market, have likewise their bearing.

This brings us to the acknowledgment of our contemporary that the Companies concerned did not utilize the opportunity of inflicting upon the gas consumers the full disadvantage imposed last year by the price of coal. It requires—this is contrary to buyers' experience in the coal market and in the markets for many other necessaries of our daily existence—a great deal of provocation to induce gas suppliers to raise the price of gas. And it must be remembered that all the Companies statistically reviewed by our contemporary did not advance their prices. This ability to remain at the old price depends on what it stood at, the amount of the undivided balance, the state of the reserve fund, and so forth; so that here again deductions from averages are of little value. Still this is what is found, taking the averages of the eight Companies. Raw material last half year cost an average of 2·3d. per 1000 cubic feet more than in the corresponding period; while the gas sales revenue (on the average) only increased, through higher prices, by 0·8d. per 1000 cubic feet of gas sold, or, adding the income obtained by the Gaslight and Coke Company from the reimposition of meter-rents, 1·3d. This demand upon the consumer was deficient by 1d. of the additional average amount paid for raw material. But adding the extra revenue from the residuals—equalling 1·1d. per 1000 cubic feet of gas sold—it is found that there was 0·1d. advantage to the suppliers on these bare figures. The forecast of the position by the Companies was therefore approximately correct. If such figures as these could be brought prominently before the general public, they would see, as our financial contemporary has ascertained, that Gas Companies are not the extortionists that perverse notion sometimes paints them.

On Imitation and Lamp Nomenclature.

THE lighting season is just upon us; and makers of gas-lamps will be turning over in their minds the question of attractive names for new productions. It is therefore a convenient time to raise a point—though not really a new one with us—pertaining thereto. It was introduced in our columns years ago when, in an unfortunate moment, someone hit for the first time upon the pseudo-description of the "gas arc" lamp. It was merely the similarity in external appearance to the electric arc lamp of a class of gas-lamp that early became popular with shopkeepers, that suggested the title. But shape and style did not give the faintest shadow of justification for the use of the word "arc." There is nothing of an "arc" about lights the source of which is gas; and to use the expression in such relation is simply trading under, to all, an obviously false description. Trespassing in the electrical field in search of titles is not dignified; and it exposes, and deservedly so, the makers of gas appliances who wander in this way to the shafts of sarcasm and ridicule of the electrical press and electricians generally. It also infers a popularity for electric lamps the negation of which is found in the abundance of the gas business. Not finding any justification for this trespass, we cannot defend the makers; on the contrary, we admit that our competitors are fairly entitled to protest, as they have done and are still doing, against unreasonable depredation in designation.

The "Electrical Times" has raised the question afresh, in its own peculiar style. With the style, we have nothing to do; but with the essence of the protest, there is full and cordial agreement, so far as it refers to appellation and not to form. Our contemporary must not console itself with the trite saying that "Imitation is the sincerest form of "flattery." "To take a pride," it remarks, "in making an "imitation that looks just as good as the real thing, is a "confession that the real thing is superior." Error in this instance underlies the statement. Development in form and style of gas-lamps has proceeded not in imitation of the electrical lamp, but in consequence of the revolution that the incandescent mantle brought about in gas lighting, and the new ground that it opened up for ingenuity in expanding utility and in gaining efficiency. Form and style (apart from the ornamental) in the construction of modern gas-lamps have in most particulars reason other than mere imitation to support them.

The types of lamps misnamed "gas arcs" were the most appropriate products that the incandescent mantle made possible to meet the exterior lighting demands of shopkeepers. Lamps of the size and shape would have been absolutely unsuitable for the old open flat flames. Take, too, the bijou inverted lamp, the resemblance of which to incandescent electric lamps, together with the superior efficiency in relation to cost, has caused so much resentment in electrical circles. Whence has this lamp come? Not from any copying of the incandescent electric lamp. First there was the bunsen burner, then came the invention of the vertical mantle by Welsbach, the two combined gave an intensity of illumination at a cost that had never before been approached. But there was a demand for a light that should have greater power in the downward direction. What more natural than that the bunsen burner should be inverted and a mantle be designed for suspension from the nozzle, with various adaptations for securing the highest efficiency and usefulness. The inverted gas-burner has brought unexpected results, in addition to realizing the primary object of producing a greater light immediately beneath the source than was possible with the vertical burner. While the primary object was attained, there is still, through the shape of the inverted mantle, an excellent diffusion of light in all serviceable directions. Again, very naturally, came the subdivision of the light of the large inverted burners; the result being the economical bijou form of burner. With these inverted lamps, the glassware was from the first also constructed in fashions that followed very much on the lines of the glassware used with the vertical burners; among the styles being glasses narrowing at the top—so fashioned to give the mantle the benefit of concentrating the upward heated air currents upon the mantle. When the bijou inverted burner came into being, smaller glasses were made with top suspension; and their small size on the inverted burner gave them, through the rounding of the lower parts, very much the appearance of the incandescent electric lamp—more especially when the bottoms of the glasses were enclosed, and inlets for lateral air supply were provided, to satisfy those who fancied that danger lurked in the open-bottomed globe of

an inverted mantle lamp. Reflectors of various shapes have been long used with incandescent burners; and with a conical shaped reflector on a bijou lamp and the old pear-shaped globe, there is something that bears a striking likeness to the very ordinary incandescent electric lamp, suspended from a flexible wire. But this striking likeness is not the outcome of any intentional imitation. It is quite an ordinary and natural development in combination through the inversion of the bunsen burner.

It is such a lamp that has raised the protest in the "Electrical Times." So far as form goes, the charge of imitation is groundless. Even if it had foundation, we have yet to learn that the electrical industry has exclusive rights to any particular form of globe or reflector. Demands sometimes spring up for certain styles; but fashion is anything but a safe arbiter of utilitarian superiority. Therefore, however this matter is looked at, we cannot plead guilty to imitation in form. Lamp appellations are quite another matter; and, on this head, there is, on our part, complete accord with our protesting contemporary. The lamp that has raised resentment is that which has been named the "Electrin." It is mentioned here not with the object of giving it prominence; but solely because it is an excellent illustration of a name without right or justification in respect of descriptive applicability. It is a false title, which, in our opinion will incite more derision than trade. If the style is what a consumer requires, he will purchase not on account of the name, but because it suits the object for which he needs such a lamp. The makers of gas lamps and fittings have shown excellent designing fertility; and, as a matter of fact, in the design of gas-fittings to-day, the opportunity is as broad for the exercise of artistic ability as is offered by electric lighting. The makers of fittings have made good and profitable use of this opportunity; and in merit we can vie with anything that has been produced by the electrical manufacturing industry. But while there has been such a big display of originality in design, there has been a beggarly display of originality in the naming of lamps. And we do emphatically say it is an evidence of this when we find makers running into the field of rivals, and appropriating titles to which they have no fundamental or other right. The very strength of the position of the gas industry should keep manufacturers from this foolish practice; and we hope that gas managers and engineers will refuse to countenance it by leaving such names out of their advertising literature. In our judgment, their use will do vastly more harm than good. The sneer of our contemporary as to designation cannot be resented; but we can dissociate the greater part of the gas industry from endorsing the adoption of this form of false nomenclature.

A Beneficial Act.

THE expiry of the year's grace allowed by the Patents Act of 1907 to foreign holders of patents abroad—patents of four years' standing—to commence working them to a reasonable extent in this country, expired on the 28th ult.; and the event has caused, by the notice taken of it in the Daily Press, quite a little sensation. It offers illustration of the rooted indifference of humanity to warnings and menaces of the age until the crisis actually arrives. When the Bill was running its course through Parliament in 1907, at the time it became an Act, and during the year granted to the foreign patentee to comply with the dictates of the Act, very little was heard of the opinions of those abroad who were to be mainly affected. A number of manufacturers whose operations had been conducted entirely abroad, at once accepted the inevitable, and quietly pursued the course that offered no alternative. But those abroad who have lately been making most noise over the matter are those who have neglected the opportunity an indulgent British Parliament permitted them; the hubbub having proceeded chiefly from Germany—America, while naturally preferring the old conditions, agreeing that right is on the side of Great Britain, and that their own past admits of no legitimate resentment. Reciprocity does not dwell alone in benignity, but it has an equally important existence in the preservation of right and equality and in defence. But though the terms may have a resemblance to their own, there are some people who do not like reciprocity if, to them, disadvantage ensues. And patentees residing in countries with heavy tariffs on imports do not appreciate the Patents Act of 1907. Those countries claim the right to make their own laws; and that right they exercised in levying their tariffs. Equally this country has exercised the right of demanding a *quid pro quo* for the protection that is afforded to foreign patentees by this country; and Mr. Lloyd-George asserts that the demand is going to be rigidly enforced.

One of the effects of the Act is that anti-protectionists have been shown that the liberty of Cobdenism is not—in view of what other nations have done—altogether applicable to present days, if the country's commerce, industry, and labour are to be amply protected. They have hitherto declined to look fairly and squarely at the distinct difference between defence and offence; but, by taking a leaf out of the book of the protectionists, the active section of the anti-protectionists have done an injury to their own tenets while conferring an (as yet) inestimable advantage upon the country. Time alone can disclose the full effects; but there is sufficient effect in sight to satisfy. The importance of the enactment to commerce, industry, and labour is great. Already money has been spent in this country by several foreign firms—including aniline dye manufacturers and oil-gas plant makers—on sites and factories; and arrangements are being negotiated for the manufacture of, and trading in, other patented goods. British manufacturers are thus being placed on more level terms with foreign competitors; and there will be still greater scope for the employment of labour. The new factories and the increased provision for manufacture will yield its increase to the imperial and local revenues; and through the new comers and the extension of industry, there must be in degree an expansion of expenditure in the country. There is no doubt whatever that the indirect effects of the Act will be of a character that will not look small in comparison with the direct effects. Computation has been made that the Official Journal of the Patent Office has, during the past few months, advertised over 1700 offers of working licences, about 80 per cent. of which relate to the engineering and allied trades. This is not bad for a start in giving British manufacturers an opportunity of exploiting inventions which, but for the Act, would be exclusively worked abroad. Now that foreign patentees are fully aware of the new position they occupy in their relationship with this country, they will try to avert all risk. Those who are negligent will not have anyone but themselves to blame.

M. Marquisan's Researches.

"New Processes in the Carbonization of Coal for the Production of Illuminating Gas" is the full title of the paper which M. Marquisan, the Honorary Treasurer of the Société Technique du Gaz, read before the Société des Ingénieurs Civils in Paris on the 1st of May last. It was noticed and summarized in the "JOURNAL" for June 9, p. 629. We refer to it again because the paper has now been republished in pamphlet form, consisting of 104 pages, with 32 illustrations and diagrams and two plates. One of the latter gives outlines of various methods of retort-stoking—the Cie. Parisienne machines by MM. Harlé et Cie., the De Brouwer projector, the Coze inclined retort, and the Oberspree (Berlin) installation of vertical retorts. The other plate gives fifteen small photographic views of the Bueb vertical retorts at Cologne and Oberspree, the Woodall-Duckham system, and the gas-ovens at Hamburg. The paper itself does not call for any further comment here, as it was fully dealt with in the "JOURNAL" referred to. But it has been extended and brought down to date by including in it summaries of the papers and discussions on vertical retorts and gas-ovens, which were read and took place at the three annual gas meetings this year in London, Berlin, and Paris respectively. In addition, Professor Bone's lecture before the Institution of Gas Engineers, Mr. R. Forbes Carpenter's recent report, and Dr. Lessing's contribution on the carbonizing chambers at the Hamburg Gas-Works, given in the "JOURNAL" for July 14 last (p. 94), are commented upon. It only remains to say that M. Marquisan's lengthy and valuable review of the various systems in vogue to-day for the carbonization of coal is a notable addition to the literature of the subject, and a useful collective summary of the many articles upon it. It embraces a great variety of views, often conflicting, and contributions from many pens in several languages; and its compilation must have entailed a vast amount of labour. Its sources being so varied, it is perhaps rather too critical to note inaccuracies and inconsistencies in the spelling of names, such as De Brouwer without the "u," and Duckham without the "h." We also think it a pity that so much labour having been spent upon such a compilation, a little more was not added to it by

the provision of an index, which would have greatly increased the utility of the pamphlet for reference purposes. Apart from this little grumble, our congratulations and hearty thanks are due to M. Marquisan for his successful and useful contribution to a wide and complex subject.

Gas Supply in Australia.

We were able to publish in last week's issue of the "JOURNAL" a report of the proceedings at the meeting in July of the Australian Gaslight Company, at which were submitted the accounts for the half year to June 30; and this is followed to-day by simila information with regard to the Melbourne Metropolitan Gas Company. In both instances the accounts tell the same tale—one of continued all-round progress. In the case of the Australian Gaslight Company, whose operations are carried on in Sydney, the Chairman (Mr. G. J. Cohen) was able to inform the shareholders that, as compared with the first half of the preceding year, there had in the past six months been an increase in the gas consumption of 53 million cubic feet, or about 6 per cent.; the total quantity sold having been 959 million feet. An interesting point in connection with the undertaking—as showing that the advantages arising from the use of gas for cooking, heating, and power purposes are becoming more and more appreciated in the Colony as time goes on—is that the stage has now been reached when the day and the night consumptions are nearly equal; the former being over 46 per cent. of the total output. To cope with the continually increasing demand, a new retort-house is at present in hand; while plans for a further house are under consideration. At Melbourne, the increase in consumption was a little greater, at 6¾ per cent.; the quantity of gas sold having been about 756 million cubic feet, as against 708 million feet in the first half of last year. The Chairman (Mr. John Grice) explained that the slot-meter business is rapidly extending—close upon 10,000 of these meters having been fixed since the initiation of the system in October, 1904. In view, too, of the fact that the Company make it a rule not to instal a prepayment meter where an ordinary one has hitherto been used, it follows that the whole of the consumers who have had slot meters fixed are absolutely new customers. Retort-house extensions have with this undertaking also been recently carried out; and in this connection attention may be drawn to the interesting illustrated particulars of the Company's works supplied by the Engineer (Mr. P. C. Holmes Hunt), which were given in last week's instalment of Mr. Maurice Graham's articles "Round the World—and Some Gas-Works." Further reconstruction work is being postponed as long as possible, in order to see whether the vertical retort system can be advantageously adopted. From the extensions already carried out, it is gratifying to learn that improved results are being experienced. Altogether, it can be safely said that the gas industry is as flourishing in Australia as it is at home; and no more favourable comment than this on the state of affairs could be made.

Asylum Lighting and its Cost.

Although, perhaps, it is a little late in the day, the decision of the Cornwall Asylum authorities to light the older part of that institution by incandescent gas is one which will commend itself to the ratepayers of the county, as it no doubt will to the officials of the Asylum. According to the estimate submitted by the Manager of the Bodmin Gas Company, the immediate effect of the change from flat-flame to incandescent burners will be a saving of upwards of £300 per annum on an expenditure which now amounts to £760; while the efficiency of the lighting will be increased by at least 50 per cent. Some members of the Committee were inclined to lament that the improvement had not been carried out years ago; and there was a little recrimination between them apparently because it had not been thought of in years gone by. However, this is a case in which it is better late than never. If there is matter for regret, it is that the subject of improved lighting did not attract attention before the erection of the new portion of the Asylum. If it had, something might have been saved by the adoption of gas lighting for the building, instead of installing the electric light there. What that has involved in capital outlay is partly shown by the fact that the estimated cost of wiring the old building and of certain supplementary plant was £3000, against an expenditure of from £80 to £100 on converting the existing gas-fittings to the incandescent system. It is to the credit of the Bodmin Gas Company that, in face of the competition of the electric light actually installed under the same roof, and with a considerable amount of surplus plant awaiting employment, they have been able to hold their own and more. The whole circumstance goes to show that there is still a large field in which modern gas lighting may be profitably developed. Old conditions are maintained in many institutions besides the Cornwall Asylum; and the flat-flame burner continues to linger in out-of-the-way corners which it has been accustomed to illuminate, more or less satisfactorily, for half-a-century. When the old and the new conditions in lighting are brought into juxtaposition, as they have been at Bodmin, the advantages of modern improvements become so apparent that there is an irresistible demand for their adoption. Without some such contrast, there is a natural tendency to leave things alone, in the comfortable assurance that what has sufficed in the past will still serve its turn. It is a shock to this innate conservatism to discover that a change will not only produce much better results, but actually cost less money.

PERSONAL.

Mr. J. W. WALKER has been appointed Chairman of the Maidenhead Gas Company, in succession to the late Mr. E. R. Lovegrove, whose death was recorded in the "JOURNAL" last week. Mr. J. F. SIMPSON is the new Vice-Chairman; and Mr. J. BUDGEN has been appointed to fill a vacancy on the directorate.

We learn from a copy of the "Bathurst Advocate" just to hand that, on the evening of the 14th of July, the friends of Mr. and Mrs. A. G. AMBROSE entertained them at a "surprise" social gathering at their residence. Mr. Ambrose, who is Manager of the municipal gas-works, is the eldest son of the late Mr. J. R. Ambrose, at one time Manager of the Bo'ness Gas-Works. There was a large attendance. Mr. J. Watt, J.P., after referring to the gathering as a representative one of the employees of the Council, presented to Mr. Ambrose a gold chain and medal, the latter bearing the following inscription: "Presented to Mr. A. G. Ambrose, Manager of the Municipal Gas-Works, Bathurst, from his Staff, as a token of esteem and regard—14/7/08." He asked Mr. Ambrose, on behalf of his fellow-employees and fellow-citizens, to accept the gift as a small *souvenir* of their esteem and affection. He also presented a silver purse, suitably inscribed, to Mrs. Ambrose—remarking that there was not a lady in Bathurst to whom one could more readily go for advice. In acknowledging the presentation, Mr. Ambrose said it had been an agreeable surprise to him, and he could not find words to express his appreciation of it. They had been a very happy family at the gas-works for a considerable time; in fact, this could be said of all the Council's employees. He hoped it might long continue. He treated his men as men, and he was certain that he could not find a more loyal set of employees. He thanked them for the presentation to his wife, who had, he said, been a first-class helpmate to him. Had it not been for her advice, he would not have remained in Bathurst.

The Late Mr. Henry Green.—At the Preston Police Court, on Monday last week, in the presence of a full attendance of Justices, Mr. W. P. Park expressed the great loss the Bench had sustained through the death of Mr. Henry Green, which was recorded in the "JOURNAL" next day, and said that as a Magistrate he displayed shrewd common-sense, admirable judgment, and great patience and forbearance. He was an affectionate, loving, and generous father; and the Magistrates desired to express their sincere sympathy with the relatives in their bereavement. Mr. Parker, on behalf of the legal profession, supported this tribute, with the remark that the solicitors had the highest possible opinion of Mr. Green's integrity, judgment, and impartiality. The funeral took place on Wednesday at Preston Cemetery, amid general manifestations of regret from relatives, colleagues, and friends.

Treatment of Coal Dust by Calcium Chloride.—At the annual meeting of the Institution of Mining Engineers in Edinburgh last week, Mr. Henry Hall, one of His Majesty's Inspectors of Mines, read a paper on this subject. He said that for many years mining experts had believed that fire-damp explosions were seriously aggravated by coal dust. To-day it held the field as the chief agent of destruction in great colliery explosions, while fire-damp had been relegated to a secondary position. The advocates of the coal-dust theory by no means maintained that dust was the cause of all explosions. What they really submitted was that it was the agent which rendered explosions of fire-damp and of certain blasting explosives capable of attaining the magnitude of a disaster. Experiments had been carried out with respect to the rate of accumulation of dust in mines under ordinary working conditions; and it had been shown that the amount was far less than had been believed. Tests had been carried out as to the effect of the calcium chloride treatment of dust; and the results achieved suggested that this method might satisfactorily solve the difficulty in dealing with dust in seams where watering could not be resorted to.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 672.)

MOVEMENTS on the Stock Exchange last week were subject to a good bit of ebb and flow. Spite of the dull season, there was more than enough activity to keep business alive and interesting, emphasized by one or two strongly-marked features—such as the demand for Japanese. Even Gas Stocks seemed to go with the tide, for on one day some foreign issues receded. The opening was favourable, with an active demand in some good lines; but Consols were shaky. The better characteristics were still predominant on Tuesday; but again the leading issues were left out. On Wednesday, Consols were a bit heavy, though they picked up a little before the close. Home Rails were weak—an additional factor for depreciation being the bad weather. Other departments were, however, brighter; and there was a good rise in Gas issues. Thursday was dull, with drooping business; and there was a disposition to sell. This state of things and continued selling proceeded on Friday; but in the afternoon a remarkable change supervened, and most markets (not Consols) had quite a cheerful recovery. However, on Saturday Consols did have a rise, and business in general was rather better; so that the end was not the worst of the week. In the Money Market, as soon as the month had closed and the Stock Exchange settlement was over, money rates eased away till they practically became quite nominal. Discount also was rather easier. Business in the Gas Market was quite as active as could reasonably be expected, and the general tendency was very firm; several important issues improving their quotations. In Gaslight and Coke, the ordinary made further progress—advancing from 98¼ (with one bargain at 98¼ free) to 99¾, a rise of a point in the quotation. In the secured issues, the maximum marked 88½ and 88¾ (a rise of ¼), and the debenture 87. South Metropolitan advanced ½, with transactions marked at from 120 to 121. In Commercials, the only deal was one in the 3½ per cent. at 103½; but the debenture advanced a point. In the Suburban and Provincial group, Brentford old and new, Liverpool "B," South Suburban, and West Ham rose 1 each; and Tottenham "A" made a big stride of 10, up to what is nearer its proper position. The only business marked was a deal in British at 42⅛ and one in West Ham at 101½. In the Continental companies, there was not much animation. Imperial receded half-a-point, changing hands at from 180 special to 182. Union was flat, and lost a couple of points; business being marked at 110¼ and 110¾. European fully-paid was firm at 23¼ and 23½. Malta marked 4⅛. Among the undertakings of the remoter world, Bombay changed hands at 6, Buenos Ayres at 11½, ditto debenture at 92 and 93½, Cape Town preference at 5½, ditto debenture at 81, Monte Video at 11⅝ and 11⅞, Primitiva at from 5⅞ to 6⅛, ditto preference at from 4 15/16 to 5 5/32, ditto debenture at 95½, and River Plate at 13 9/16.

ELECTRICITY SUPPLY MEMORANDA.

A Revival that Failed—Electric Lighting Scheme for the Flats and Tenements of Working Men—Wiring and Illumination that are Considered Good Enough—Costs to the Supplier of the Poverty-Stricken System—Gas and Electricity Costs.

"ELECTRICITY OR GAS: The Problem of the Small Consumer." This was the attractive heading to a series of disappointing articles that recently appeared in the "Electrical Review" from the pen of Mr. John D. Mackenzie. They did not disappoint us; but they must have done readers of the "Review." The author hoped they would lead to a good discussion on this problem that the electrical engineer finds so difficult; but, although the publication of the articles concluded on July 10, and an editorial upon them appeared on July 31, they have been passed by in deadly silence. This is sufficient to show that Mr. Mackenzie has failed in his object, and that there is a decided want of agreement with him regarding the ways and means that he propounds for dealing with the small consumer. There have been a great many flashes in the pan over this electricity supply problem; but, like most flashes, they have only had very temporary effect. And Mr. Mackenzie has provided an addition to the record. The weaknesses of his articles are their most prominent points; and we certainly do not think articles with such characteristics will prove of the productive value he hoped for, and have abundant growth. He recognizes that the term "The Poor Man's Light" as applied to electricity has of late been quietly dropped by the electrical fraternity. But the metallic filament lamp, with its consumption reducing power, has, in his opinion, altered the situation; and it is the medium that invokes electricians to face the problem afresh of supplying the small consumer, and to oust gas out of small houses. Practically, all Mr. Mackenzie has to say on the subject has been heard before, although in different form; and the *status quo* is maintained, and seems likely to be.

The sum and substance of Mr. Mackenzie's scheme for obtaining the custom of the occupiers of flats and tenement houses is the cheap-and-nasty order of installation, and the modicum of illumination for the poor householders, mixed with a perversion of the truth as to the relative costs of gas and electrical illumination, on which last point we will present some figures which we will ask him to justify. The scheme that he thinks good enough for the poor—the character of the installation and the illumination he would give—he would not dare to suggest for any consumer who has any respect for his house, his eyesight, or his comfort. However, let us follow the scheme that Mr. Mackenzie has been to such great pains to elaborate. The point of installation is first dealt with. The reason that Mr. Mackenzie takes flats and tenement dwellings as the ground for his articles is that he holds, if these can be dealt with, better class and more lucrative property can be handled with still more profit. He admits that as ordinarily carried out, in accordance with the approved regulations, electrical installations are more costly than gas installations. It suits Mr. Mackenzie's present purpose, however, to regard many of the rules that have been laid down for safety and efficiency as quite unnecessary and even frivolous. Experiences of disaster do not support this slighting, nor give countenance to relaxation. But to make his case good, he would flout what has been done to keep the name of electricity as unsullied as possible in the eyes of the public. Of course, the expense of installation has something to do with the price at which electricity can be sold. In the rough scheme that he considers good enough for the poor man's flat or tenement, he suggests the use of overhead wires, fed by one or two branches from the underground mains, from which overhead wires a group of flats or tenements could be supplied. It is all so simple. All that is required is an extension of a few yards of distributor cable, some lengths of service mains, and several joint-boxes; and to supply a group of eight houses, all that would have to be spent would be some £5 for material. Unfortunately for the veracity of calculation, so far as we can see, no account is taken of the cost of labour in putting in this £5 worth of material, unless the few shillings charged in fitting up each flat is supposed to cover the external work as well. For the moment, we do not want to go beyond the meter, so as to reduce the substance of the articles and the argument to the smallest possible compass. But it may be mentioned here that concerning meters, Mr. Mackenzie is only dealing with installations on alternating current circuits; and the meter is a most important point. The only low-priced instruments of measurement are the electrolytic meters; and these he puts out of court, as he is unaware of one that can be used on alternating current circuits.

The articles are not humorous ones; they have been written seriously, and are intended to be so regarded. We hope that readers will, therefore, take Mr. Mackenzie in the right spirit, as we endeavour to do. The suggestion is necessary, as he goes on to picture for these poor consumers an installation "of from two to three lamps, each using (say) 25-volt 16-candle Osram lamps, consuming 20 watts per lamp." One room one 16-candle lamp seems to be Mr. Mackenzie's prescription for the three-light "houses." During dark hours, this ungenerous electrician would have these people dwell in a sort of artificial twilight. He assumes for the purpose of calculation a minimum use per annum by such consumers of 2400 lamp-hours, which, at 20 watts per lamp, gives an annual demand of 48 units, with a maximum demand at any one time of 0·042 kilowatt. We will not go through the whole of the figures; but Mr. Mackenzie arrives on this basis at these results per unit for the 48-unit consumption per annum: Generating machinery, 0·525d.; mains and distribution, 0·42d.; meter, 0·75d.; generating costs, 0·9d—total, so far, 2·595d. per unit. It will be noticed that the meter is the highest item of the four. However, although the bare cost of 2·595d. includes the meter, it does not include the cost of the service amterial nor the fitting-up of the flats or tenement. Assume now a working pressure of 200 volts alternating; and a group of eight dwellings (if the consumers of a block of eight flats or tenements can be obtained who are of one mind on the subject of electric lighting by the aid of 16-candle power lamps), each requiring a maximum demand of 0·042 kilowatt. The plan contemplates the installation of a balanced auto-transformer, taking 200 volts across the outers, and having eight branches, giving 25 volts per branch to supply the eight consumers. A simple and cheap system of installation, in the opinion of Mr. Mackenzie, is all that is needed in such places. Of course, with a pressure of only 25 volts, danger is minimized; but where people are huddled together in blocks of tenements of the kind the scheme is intended for, we should prefer not to run any risks. Now, in the first place, the materials required to be found by the electricity supplier, including the eight circuit auto-transformer, would cost £5. This outlay would add 0·34d. per unit to the 2·595d. per unit previously arrived at. Then the all-day electrical loss of the transformer per annum per individual consumer is taken as 11 units (nearly one-fourth of the consumption of 48 units!); and, taking this, at the actual generating cost per annum, without adding anything for plant and distribution charges, there is a further addition to cost per unit of 0·2d. Now we have a total, with all the paring-down practised, of 3·135d. per unit without any profit, but including depreciation, interest, and sinking fund.

There is still the fitting of the dwellings to be done; and anything will do for them, including flexible wiring. Doing the work in the cheapest style, a two-apartment house using three 16-candle lights only—one in the lobby, one in the kitchen, and one in the room—would cost £1 4s. 9d.; and for a three-apartment house with five lights, £1 13s. 7d. The consumer or someone else has to pay for the interior installation; and with it the initial and renewal costs of the metallic filament lamps. However, what it all works out to is that, if someone—not the electricity suppliers—pays for the interior fitting, and the metallic filament lamps,

these consumers, who bring upon the electricity suppliers a cost of 3·135d. (so far as Mr. Mackenzie takes us) could be supplied, he thinks, at 3½d. per unit—thus showing a profit per unit of 0·165d., at which figure the profit on the 48 units supplied per annum would amount to 7·92d.! Are there no other expenses that these small consumers would occasion, and which would more than absorb this 7·92d.? Just look down the expenditure side of the revenue account and examine each item carefully, and then say.

Now we come to the point on which a very direct challenge may be issued to Mr. Mackenzie. He refers to some comparative tests in an unnamed public institution in which incandescent gas-fittings were replaced by metallic filament lamps, and flat-flame gas-burners were replaced by the equivalent of carbon filament lamps. He does not disclose anything as to the number of incandescent gas-lamps nor of flat-flame burners that underwent substitution by the electric lamps. He is vague and economical in his information, professing an inability to publish *in extenso* such simple matter as this in the absence of the necessary authority. But he attributes to the tests a "distinct value in coming to a decision;" and he expects his *ipse dixit* to be accepted that there was an "increased" amount of light obtained by the change. So confident is he of the result, as an "accurate approximation to every-day results," that he finds it possible to equate electricity and gas as follows:—

Electricity per Unit.		Gas per 1000 Cubic Feet.
3d.	is equivalent to	1s. 10½d.
3·5d.	,, ,,	2s. 2½d.
4d.	,, ,,	2s. 6d.
4·5d.	,, ,,	2s. 9¾d.
5d.	,, ,,	3s. 1½d.

He adds that these figures are not "unduly favourable" to electricity is evident on examining the result of a recent comparative test of Block light mantles and Osram lamps, in which the figures work out as 3·25d. per unit of electricity and 2s. 6d. per 1000 cubic feet of gas, on an equivalent candle-power basis. He is prudent in saying that he does not put forward any of the foregoing figures as "absolutely authoritative;" but, from what he has previously said, he does put them forward as a "fairly accurate approximation." Now let us see. In another part of his article, he gives the consumption of electricity for a 16-candle power Osram lamp as 20 watts per hour. The common incandescent gas-burner will give (of course, varying a little with the quality of gas) 18 candles per cubic foot of gas consumed; and the bijou inverted burner, from 20 to 25 candles. The latter burner is the nearest one to take in a comparison with a 16-candle Osram lamp. The price of gas supplied to the institution in question was 2s. 8d. per 1000 cubic feet; of electricity, 3d. per unit. Therefore, 1000 cubic feet of gas consumed in an hour in bijou inverted gas-burners, should, on a quite modest computation, give 20,000 candles. For 2s. 8d. (we will allow Mr. Mackenzie the advantage of the odd penny), 11 units of electricity at 3d. can be purchased, or the equivalent of 11,000 watts. Divide the 11,000 by 20, and we find that 550 16-candle lamps can be supplied by the 11 units for an hour. 550 × 16 = 8800 candles. Now supposing equivalent illumination (Mr. Mackenzie says there is increased light from the electricity), it would mean that only 8·8 candles can be obtained per cubic foot of gas from incandescent gas lighting. But Mr. Mackenzie goes farther. He asserts that 3d. per unit is equivalent to gas at 1s. 10½d. We are not going to let him shuffle from his point on the ground that some of the burners were flat-flame ones that were used in the institution in question. It is discreditable of any electrical engineer to employ flat-flame figures in comparisons to-day. But perhaps Mr. Mackenzie will not desire to shuffle from them, as later on he adopts, in the Block light and Osram test, the comparison of 3·25d. per unit of electricity and 2s. 6d. per 1000 cubic feet of gas as being "an equivalent illuminating power basis." For 1s. 10½d., 7½ units of electricity at 3d. per unit can be purchased. Therefore, 7500 watts will be capable of supplying, at 20 watts per lamp, 375 16-candle power lamps; and 375 × 16 = 6000 candles. If 3d. per unit is the equivalent of gas at 1s. 10½d. per 1000 cubic feet, then gas is only capable of giving a value in incandescent burners equal to 6 candles per cubic foot! Take the Block light and Osram lamp comparison, 9½ units at 3½d. per unit are alleged to be equivalent to gas at 2s. 6d. per 1000 cubic feet. Worked out as before, the efficiency ascribed to gas used in an incandescent gas-burner is only 7·4 candles per cubic foot. We challenge Mr. Mackenzie to justify the 8·8, the 6, and the 7·4 candles per cubic foot of gas consumed. If he does not do so, then our charge will stand as to the worthlessness and untruthfulness of his "equation" of gas and electricity, and of his declaration that, "on the score of burning costs, electricity can compete on at least equal terms with gas." On the whole, we do not think Mr. Mackenzie has contributed very much to the solution of the problem as to how the homes of working men are to be captured for electric lighting.

In another part of the "JOURNAL" we give an abstract of the Presidential Address of Dr. F. S. Kipping, F.R.S., in the Chemistry Section of the British Association, now meeting in Dublin. Dr. Kipping, who is Professor of Chemistry at University College, Nottingham, was formerly Chemist at the Manchester Gas-Works.

GAS UNDERTAKINGS RETURNS.

Official Figures as to Gas Supply.

THE returns relating to the gas undertakings of the United Kingdom for the year ending Dec. 31, 1906, in the case of the Companies, and March 25, 1907, for the Local Authorities, were issued last Wednesday—just one year and seven months later than in the case of the preceding returns. They were ordered to be printed as long ago as Aug. 26, 1907. The matter in both returns has been compressed; so that the pages are reduced in size—being now 13 in. by 8½ in., compared with 14 in. by 9½ in. before. This has been effected by bringing the particulars previously given in the second column, headed "Acts of Parliament or Provisional Orders," into the first column, under the name of the Company or Local Authority. The particulars furnished are unchanged in character, and they occupy in each case the same number of pages. The paper is, however, somewhat thinner.

Particulars are furnished this year in reference to 763 undertakings, compared with 752 before. The new-comers among the Companies are Charing, Corsham, Crediton, Dowlais, Newport Pagnell, Pontardulais, Raunds, St. Austell, Truro, and Wollaston; and Elham Valley drops out. The total number of Local Authorities is 272, compared with 270 before; the new entries among the latter being Withnell and Wolstanton. The capital authorized for the 763 undertakings (including other purposes than gas supply in certain cases) is £148,455,448, of which £126,565,460 has been paid up and borrowed. The total receipts are: Companies, £18,166,087; Local Authorities, £9,843,243—making the total receipts, £28,009,330.

The statistics relating to working show that 14,846,257 tons of coal were carbonized; the quantity of gas produced being 181,841,076,000 cubic feet, of which 167,945,206,000 cubic feet were sold. The total make is inclusive of 20,078,273,000 cubic feet of water gas and 90,000 cubic feet of acetylene gas. The totals in the preceding returns were: Coals, 14,480,325 tons; gas made, 174,904,791,000 cubic feet, of which 161,407,725,000 cubic feet were sold; the make being inclusive of 19,736,859,000 cubic feet of water gas and 101,250 cubic feet of acetylene gas. The extended use of water gas is shown by the following figures in the totals for the Companies in the past seven years. In 1900, the quantity supplied was 8,945,670,000 cubic feet; in 1901, 11,410,279,000 cubic feet; in 1902, 12,407,734,000 cubic feet; and in 1903, 13,056,741,000 cubic feet; in 1904 the make was 13,718,857,000 cubic feet; in 1905, 14,762,584,000 cubic feet, and in 1906, 14,930,653,000 cubic feet (the sales in these three years not being given). The figures for the Local Authorities are: In 1900-1, 3,162,782,000 cubic feet; in 1901-2, 3,955,621,000 cubic feet; in 1902-3, 4,459,916,000 cubic feet; in 1903-4, 4,850,007,000 cubic feet; in 1904-5, 5,033,643,000 cubic feet (make only); in 1905-6, 4,974,275,000 cubic feet (make), in 1906-7, 5,147,620,000 cubic feet (make).

At the date to which the last returns were made up, there were 32,690 miles of mains in use to supply 5,363,533 consumers and 677,980 public lamps. The preceding figures were: Miles of mains, 30,931; consumers, 5,064,075; public lamps, 665,791.

With regard to carburetted water gas, the returns show that when they were made up it was being supplied by the following Companies and Local Authorities; the maximum proportions of its admixture with coal gas (except where averages are stated) being given in parentheses.

Companies.

Alliance and Dublin (50).
Aylesbury (27).
Barking (17).
Bath (50).
Bexhill (38·95).
Bournemouth (35).
Bilston (about 10).
Bognor (30).
Brentford (36·5).
Bridgwater (27·46*).
Bridlington (33).
Brighton (39·75).
Cleethorpes (15).
Colchester (24).
Commercial (44·7†).
Croydon (44, av. 29).
Dartford (19).
Dorking (50).
Durham (20 estimated).
Eastbourne (49·6).
Epsom (36).
Falmouth (20).
Faversham (not stated).
Folkestone (33·33).
Gaslight and Coke (‡).
Gosport (35).
Gravesend (34).
Guildford (25 to 33⅓).
Hampton Court (30).
Harrow (46).
Hartlepool (§).
Hastings (42·42‖).
Hornsey (41·25).
Horsham (39).
Hull—British (34).
Ilford (19·06).
Ipswich (25).
Kingston-on-Thames (25).
Liverpool (50).
Lea Bridge (56, av. 48).
Londonderry (15, av. 12).
Maidenhead (40).
Malton (about 24).
Marlborough (33).
Merthyr Tydfil (28).
Mitcham (49).
Newcastle (8·87 one wk.).
Newport, Mon. (26).
North Middlesex (57·75).
Norwich—British (43·7).
Nuneaton (25).
Plymouth (45·53).
Portsea Island (36·2).
Prescot (24·18).
Preston (40·4 av. for one week).
Ramsbottom (25).
Reading (37·6).
Redhill (33).
Rochester (33).
Romford (32).
Rushden and Higham Ferrers (18·2, av. 13·76)
Scarborough (25·5).
Southampton (34).
Southend (48·62).
Southgate & District (52).
Staines and Egham (25).
Stretford (27).
Swansea (22·5).
Swindon United (av. 28).
Taunton (35).
Tonbridge (25).
Tottenham (62).
Tunbridge Wells (25 to 30)
Wandsworth (30·4).
Watford (32·05).
West Ham (55).
Weston-super-Mare (28).
Wexford (20).
Winchester (33).
York (20·29).

* Average 19·29. † Average 30·3. ‡ Of the total quantity of gas sent out by the Company, 12 per cent. was unmixed with water gas. As regards the remainder, 62 per cent. contained a maximum proportion of 24 per cent. of carburetted water gas; 8 per cent., a maximum proportion of 34 per cent.; 11 per cent., a maximum proportion of 35 per cent.; 11 per cent., a maximum proportion of 37 per cent.; and 8 per cent., a maximum proportion of 40 per cent. § About 25 per cent.; average about 17½ per cent. ‖ Average for the year, 24·07 per cent.

Local Authorities.

Accrington (20).	Edinburgh (9).	Oldham (44‡).
Barrow-in-Furness (21·6).	Halifax (10).	Paisley (§).
Belfast (52).	Hebden Bridge (25 to 30).	Pontypridd (32·3).
Birkenhead (33·31).	Leeds (16·8).	Rochdale (30).
Birmingham (25).	Leicester (0·14).	Smethwick (17).
Blackburn (25).	Leigh (2·53).	Southport (46·21).
Burnley (35).	Lincoln (33·33*).	Stafford (15·9).
Carlisle (29·28).	Longton (about 30).	Stockport (25).
Coventry (33·58).	Loughborough (15).	Stockton-on-Tees (31·7).
Devizes (30·5).	Manchester (21·31†).	Tipton (0·39).
Devonport (27·14).	Middlesbrough (no limit).	Todmorden (18·39).
Dundee (25).	Oldbury (20).	West Bromwich (21·3).

* In the daytime; none at night. † On total output. ‡ At one station only and on one day only. § Oil gas, 1·57 per cent.

Two new Companies—Ipswich and Nuneaton—appear in this list. The new Local Authorities furnishing returns are those of Devizes, Devonport, Leicester, Pontypridd, and Rochdale. Chorley and Nottingham drop out.

As in previous returns, particulars are furnished regarding the nature and quantity of materials other than coal used for the manufacture of gas. The extent to which oil, petroleum spirit, carburine, or "other material" is being utilized will be seen from the following list of Companies and Local Authorities who make returns:—

Companies.

Alliance and Dublin.	Gosport.	Portsea Island.
Alton.	Grantham.	Prescot.
Aylesbury.	Gravesend.	Preston.
Barking.	Guildford.	Quorndon and Mountsorrel.
Bath.	Halesowen.	Reading.
Bexhill.	Hampton Court.	Redhill.
Bognor.	Harrow and Stanmore.	Richmond.
Bournemouth.	Hartlepool.	Rochester.
Brentford.	Hastings.	Romford.
Brentwood.	Hornsey.	Rushden and Higham Ferrers.
Bridgwater.	Horsham.	Scarborough.
Bridlington.	Hull (British Co.).	Shrewsbury.
Brighton and Hove.	Huyton and Roby.	Southampton.
Bristol.	Ilford.	Southend.
Broadstairs.	Ipswich.	Southgate and District.
Canterbury.	Isle of Thanet.	Staines and Egham.
Cleethorpes.	Kingston-on-Thames.	Stretford.
Coatbridge.	Lea Bridge.	Sutton and Hooton.
Colchester.	Littleborough.	Swansea.
Commercial.	Liverpool.	Swindon.
Croydon.	Londonderry.	Taunton.
Dartford.	Maidenhead.	Tonbridge.
Derby.	Malton.	Tottenham.
Dorking.	Marlborough.	Tunbridge Wells.
Dover.	Merthyr Tydfil.	Tynemouth.
Durham.	Mitcham and Wimbledon.	Cheshunt.
Eastbourne.	Newcastle-upon-Tyne.	Waltham Abbey and Waltham Cross.
Epsom and Ewell.	Newport (Mon.).	Wandsworth and Putney.
Exeter.	Northfleet.	Watford.
Falmouth.	North Middlesex.	West Ham.
Faversham.	Norwich (British Co.).	Weston-super-Mare.
Folkestone.	Nuneaton.	Wexford.
Gaslight and Coke.	Plymouth.	Winchester.
Godalming.		York.

Local Authorities.

Abertillery.	Dundee.	Oldbury.
Accrington.	Dunfermline.	Oldham.
Airdrie.	Edinburgh and Leith.	Paisley.
Alloa.	Glastonbury.	Perth.
Alva.	Greenock.	Pontypridd
Arbroath.	Halifax.	Portsoy (acetylene gas only).
Ashburton.	Hebden Bridge.	Rochdale.
Ashford.	Helensburgh.	St. Helens.
Barrow-in-Furness.	Hereford.	Smethwick.
Belfast.	Heywood.	Southport.
Birkenhead.	Ilkeston.	Stafford.
Birmingham.	Leeds.	Stalybridge.
Blackburn.	Leek.	Stratford-on-Avon.
Blackpool.	Leicester	Stockport.
Burnley.	Leigh.	Stockton-on-Tees.
Bury.	Lincoln.	Tipton.
Carlisle.	Longton.	Todmorden.
Coventry.	Loughborough.	Torquay (St. Mary Ch.).
Darlington.	Manchester.	Walsall.
Darwen.	Middlesbrough.	Warrington.
Devizes.	Middleton.	West Bromwich.
Devonport.	Mossley.	Wigan.
Dumfries	Nottingham.	

The new names in the above lists are the Broadstairs, Ipswich, Nuneaton, Quorndon, and Waltham Abbey Gas Companies, and the Abertillery, Devizes, Devonport, Dumfries, Leicester, and Pontypridd Local Authorities. On the other hand, the Great Marlow, Mid Kent, Musselburgh, and South Suburban Gas Companies and the Chorley Corporation drop out. The Gas Commissioners of Portsoy used 10 tons of carbide of calcium in the manufacture of 90,000 cubic feet of acetylene gas, of which 66,766 cubic feet were employed for private and 21,850 cubic feet for public lighting—together 88,616 cubic feet, at the price of 5s. 6d. per 100 cubic feet—a reduction of 6d. since the issue of the previous returns.

Comparing the figures furnished by the present returns with those contained in similar returns for the previous nine years, it will be seen that the Companies show as follows:—

Year.	Share and Premium Capital Paid Up.	Loan Capital Issued.	Receipts.	Expenditure.
1897. . .	£42,368,976	£8,891,218	£13,444,570	£9,922,822
1898. . .	44,134,488	9,360,293	14,092,125	10,309,948
1899. . .	57,937,016	11,451,134	15,514,700	11,478,442
1900. . .	59,638,877	11,775,642	17,638,963	13,864,808
1901. . .	62,775,845	12,201,533	17,955,187	14,537,797
1902. . .	64,299,112	12,829,925	17,205,002	13,167,186
1903. . .	67,417,798	13,451,381	17,756,626	13,214,322
1904. . .	68,953,306	13,775,734	17,828,872	13,397,727
1905. . .	70,605,726	14,176,599	17,617,598	13,410,307
1906. . .	72,008,451	14,467,842	18,166,087	13,671,369

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas Made.	Number of Consumers.	Public Lamps Lighted.
1897. . .	7,963,465	84,040,175,901	1,549,627	314,451
1898. . .	7,958,669	86,705,722,752	1,670,847	319,007
1899. . .	8,321,187	91,794,898,282	1,817,649	324,166
1900. . .	8,426,853	94,869,749,232	1,945,825	326,813
1901. . .	8,580,365	97,386,618,553	2,048,359	326,209
1902. . .	8,520,004	99,676,048,000	2,197,987	333,308
1903. . .	8,528,823	101,490,084,000	2,385,348	335,363
1904. . .	8,673,343	105,311,980,000	2,588,917	343,908
1905. . .	8,722,145	109,823,682,000	2,813,156	350,113
1906. . .	8,922,781	114,528,923,000*	3,023,619	356,070

* Including 14,930,653,000 cubic feet of water gas. Number of cubic feet sold, 105,218,682,000.

The somewhat similar figures for the Local Authorities are—

Year.	Amount Borrowed, including Annuities (not deducting Repayments).	Receipts.	Expenditure (exclusive of Amount in the next Column).	Interest, &c., Paid.*	Net Profit after Payment of Items in preceding Column.
1897-98 .	£27,376,324	£6,759,883	£5,058,705	£1,161,171	£554,014
1898-99 .	28,614,971	7,177,670	5,365,995	1,219,771	625,780
1899-00 .	29,658,730	8,048,089	6,155,725	1,280,168	663,189
1900-01 .	31,509,701	9,121,418	7,463,693	1,353,259	409,802
1901-02 .	34,045,442	9,300,567	7,630,856	1,467,232	414,091
1902-03 .	35,738,023	9,554,984	7,215,502	1,584,985	793,764
1903-04 .	37,103,279	9,819,685	7,182,008	1,700,405	967,194
1904-05 .	38,512,295	9,546,682	7,052,474	1,738,682	790,450
1905-06 .	39,401,896	9,636,107	7,085,710	1,799,094	798,210
1906-07 .	40,089,167	9,843,243	7,211,987	1,843,122	832,341

* These figures include: (1) Interest paid on loans; (2) amount paid for annuities; (3) amount of loans repaid; (4) amount paid for redemption of annuities; (5) amount placed to sinking fund.

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas Made.	Number of Consumers.	Public Lamps Lighted.
1897-98. .	4,652,688	48,652,558,526	1,475,749	239,352
1898-99. .	4,883,148	51,441,272,030	1,578,291	247,857
1899-00. .	5,289,501	55,360,659,139	1,667,908	257,040
1900-01. .	5,479,435	57,138,062,255	1,767,464	278,343
1901-02. .	5,522,264	59,300,273,086	1,872,633	287,887
1902-03. .	5,589,215	60,902,739,000	1,970,738	294,828
1903-04. .	5,673,013	62,717,759,000	1,945,777	301,308
1904-05. .	5,622,259	63,335,696,000	2,148,260	310,275
1905-06. .	5,758,180	65,081,109,000	2,250,919	315,678
1906-07. .	5,923,476	67,312,153,000*	2,339,914	321,910

* Including 5,147,622,000 cubic feet of water gas and 90,000 cubic feet of acetylene gas. Number of cubic feet consumed, 62,726,524,000.

New Pumping Plant at the York Water-Works.—The following particulars of the new pumping-engines recently constructed at the York Water-Works recently appeared in the Engineering Supplement to "The Times." The engines are of the triple-expansion Worthington surface-condensing type, and are direct acting, having six cylinders; three of each being placed tandem. The diameter of the high-pressure cylinders is 16 inches, of the intermediate cylinders 25 inches, and of the low-pressure cylinders 42 inches—all having a 2-feet stroke. The maximum speed of the steam pistons and water plungers equals 136 feet per minute; the normal speed being 112 feet per minute. There are two sets each of double-acting high-lift and low-lift pumps. The diameter of the high-lift pump plunger is 21½ inches, that of the low-lift pump plunger 22½ inches—each having gun-metal lined working barrels. The low-lift pumps lift the unfiltered water from the intake into the subsiding reservoirs. The high-lift pumps raise the water from filtered water wells into the mains supplying the city, and work with a total lift of 169 feet, or equal to 73 lbs. per square inch. Each pump contains 96 valves, 48 being on the suction and 48 on the delivery. The maximum quantity of unfiltered water raised by the low-lift pumps in 24 hours is about 6¾ million gallons, and of filtered water by the high-lift pumps about 6 million gallons; making the total pumping capacity of the entire set equal to nearly 13 million gallons per 24 hours. The engines and pumps were built by Messrs. James Simpson and Co., of Newark-on-Trent and London; and the works were carried out under the supervision of Mr. W. H. Humphreys, the Engineer and Manager of the Water Company.

TECHNOLOGY OF DESSAU VERTICAL RETORTS.

By THOMAS HOLGATE, M.Inst.C.E., F.C.S.

THE co-operation of German and British engineers manifested at the recent meeting of the Institution of Gas Engineers, is an event of such importance as to justify an attempt to extract therefrom all the information possible. By the kindness of Dr. H. Bunte, the writer has been favoured with a table giving details of the tests carried out at Mariendorf and Zurich by the Carlsruhe testing staff, which has enabled him to gain an insight into the two important questions of (1) retort length, and (2) the operation of steaming. In this article no comparison will be instituted with other vertical retort systems; but the lessons which are to be obtained by a careful sifting of the data provided by the one under consideration, will alone be sought for. The figures available from the tests of the German, as of the British technicians, appear to be concordant, as far as they go; but they are lacking in the completeness which is necessary for the absolute certitude required in drawing definite conclusions.

These deficiencies are, however, such as can be remedied; and the making clear their existence will, it is hoped, pave the way to further tests with this object in view. The tables which are subjoined have been compiled by the writer to bring out as clearly as possible the practical significance of the tests in the light of as many of the determining factors as are available. The fact that the tests of illuminating power at Zurich were not made by a No. 2 "Metropolitan" gas-burner, but by a flat-flame burner whose relative efficiency is not known, must not be overlooked; and the differences in the volatile matter from the three classes of coal employed—viz., Durham, Silesian, and Saar—must be borne in mind. Further the absence of information as to oven temperatures, as to the production of coke, and the special circumstances that determined the fuel consumption at Dessau, militate against any complete comparison. The difficulty of accurately obtaining the coke production or coke consumption is fully recognized in the British report, and must be kept in mind when interpreting the results at Mariendorf and Zurich, and in following the deductions therefrom which the writer has made.

The first significant fact to be noted is that the 5-metre retorts are not operated with a proportionate quantity of coal per 24 hours to the 4-metre ones (Table No. I., line 2). While there is 25 per cent. greater length, there is only (during the non-steaming operation) a 10 per cent. increase of coal distilled, and in the steaming operation no increase of coal distilled. The advantages of the extra length appear, however, in other ways—namely, in allowing a lower oven temperature to be employed and a greater suitability for the making of water gas, as is shown in Table II., where the conclusions of Table I. are summarized.

Lines 5 to 8 of Table I., show the important fact that the 4-metre retorts at Zurich were worked at a higher temperature than the 5-metre ones at Mariendorf; and this probably accounts for the fact shown in lines 17 and 18—that the calorific power of the gas from a ton of coal was greatest at Zurich, while lines 11 and 12 show that the illuminating results there were the lowest. The 5-metre retort was worked with an increased temperature (maximum) of 14° C. for steaming, as against an increase of 48° C. employed with the 4-metre retorts at Zurich, though the initial temperature in the latter was 42° C. higher than the former.

It is worth while pausing to consider what the temperature thus employed is, in comparison with ordinary horizontal working. The 1378° C. is equal to 2512° Fahr.—probably 300° Fahr. higher than is commonly employed. This high temperature of working, together with the low percentage of volatile matter from the Saar coal (line 23, Table I.), must be taken into account in understanding the very low candle power recorded, coincident with the highest calorific power of gas from each ton of coal. The Zurich gas evidently contained the greatest proportion of hydrogen, as is shown by the difference between the gross and net calorific powers (line 19, Table I.). The good results at Zurich appear to be due to high temperature, aided possibly by a coal, in some respects, of better quality; and this must be recognized in order to see that the Zurich figures do not invalidate the superiority due to increased length of retort at Mariendorf. The Zurich figures compare best in the non-steaming operations, and such advantages as they show appear to be obtained without excessive fuel consumption (line 26, Table I.), unless there be some disparity as to the percentage of ash in the fuel, which, however, the data recorded do not disclose. There remains, of course, the question of the durability of the firebrick structure; and, if found satisfactory, the higher temperatures could be adopted with the 5-metre retorts.

It is in the supplementary manufacture of water gas that the 5-metre retorts appear to the greatest credit. This fact is seen by the increase from 11,400 to 13,810 cubic feet of gas per ton by steaming—viz., 2410 cubic feet at Mariendorf, as against an increase from 12,180 to 13,820 (= 1640) cubic feet at Zurich; and the superiority is not lost when the net calorific power of the gas is taken into account. The former gains 11·4 per cent., as against 7·7 per cent. in the latter, and 2·2 per cent. at Dessau (line 11, Table II.).

The operation of steaming brings about a diminution of lighting values (lines 11 and 12, Table I.) per ton of coal of 3 per cent. at Dessau, with but slight steaming, and of 22·4 per cent. at Zurich, with 7·3 per cent. at Mariendorf—both with copious steaming. From the figures in Table II., line 4, it will be seen that the gain in gross calorific power by steaming was 2·3, 7·7, and 11·2 per cent. respectively for Dessau, Zurich, and Mariendorf. It also appears from Table II., lines 5, 6, and 7, that the restriction of steam at Dessau was not one of virtue but of necessity; for the small quantity passed through was not fully utilized. As a matter of fact, it would appear that the comparison of "non-steaming" with "steaming" is best made between the Zurich and Mariendorf tests where the quantity of steam admitted was more nearly equal (Table II., line 5). The steaming operation there brought about the following results:—

	Zurich.	Mariendorf.
1. Percentage gain in gross calorific power per ton of coal	7·7	11·2
2. ,, loss ,, candle power ,, ,, ,,	22·4	7·3
Ratio of 1 to 2	2·6	0·65

Probably this comparison is affected adversely to Zurich by the use of the flat-flame burner in the illuminating power tests; but as to how much is due to this, no evidence is forthcoming. The flat-flame burner could not by the alteration of the rate of consumption be made equally adjustable with the No. 2 "Metropolitan" burner to the lower quality of gas produced when steaming; so that some compensating factor is called for. It may be opportune here to suggest that in any further tests, the gases be consumed (*a*) in a No. 2 "Metropolitan" argand burner, and (*b*) in an incandescent burner consuming 5 cubic feet of gas per hour and having an air supply and pressure of gas at the nozzle adjustable to the needs of the gas being tested. In this way, it will be possible to arrive at figures that shall have some degree of appositeness, comparable to that now possessed by those for the calorific powers.

Lines 13 to 19, Table I., show how figures may be obtained that shall show the relation that exists in the hydrogen content of the gas produced. Line 6, Table II. shows the differences of line 19, Table I., due to the operation of steaming; and the ratio of this increase to the increase of gross calorific power (line 3, Table II.) is given on line 7, Table II. This ratio appears to the writer to furnish a good index of the efficiency of the retort as a water-gas producer. The ideal ratio would be 12·2; and this figure is nearly reached in the case of Mariendorf (10·75), but only rather more than half reached (6·26) in the case of Dessau, and intermediate (9·46) in the case of Zurich.

It may be advisable to explain how this inference is reached. The production of water gas ought to correspond with the liberation of equal volumes of hydrogen and carbon monoxide: $C_2 + (H_2O)_2 = 2CO + {}^2H_2$. But it may lapse into a less satisfactory reaction, if there be a too rapid flow of steam or the temperature of the carbon be too low: $C_2 + 4(H_2O) = 2CO_2 + 4H_2$. Or, again, if this declension continues, reaction may cease and only abstraction of heat by the steam, without the dissociation of the latter. The last-named stage is, of course, worthless. The previous one yields calorific gases of value after the carbon dioxide has been abstracted; but the first one is the standard of efficient working. In the resulting gases, 28 parts by weight of carbon monoxide have a calorific power of 67,670 calories, and 2 parts by weight of hydrogen, similarly, 68,360 calories. The combustion of these together give 136,030 calories, producing 18 parts by weight of water. The latent heat of steam for the 18 grams is 9660 calories, and the sensible heat from 100° C. down to 18° C. (the standard temperatures involved in the original determination), $18 \times 82° = 1476$ calories. Thus a total heat of 11,136 calories is the difference between the gross and the net calorific power of 2 grams of hydrogen. If, therefore, we know the actual amount of the latter yielded by any gas, we can tell how much hydrogen the gas contained. Thus 11,136 calories difference by condensation of steam from 100° C. to 18° C. corresponds with 68,360 calories of heat developed by hydrogen; and this ought for true water gas to be accompanied by 67,670 calories from the carbon monoxide—thus $136{,}030 \div 11{,}136 = 12{\cdot}2$ is the ratio that ought to exist. If carbonic acid is formed in the generator, the ratio will be $68{,}360 \div 11{,}136 = 6{\cdot}14$. Tried by this rule, at Mariendorf three-fourths of the water gas was fully converted to carbon monoxide, one-fourth issuing as carbonic acid; at Zurich, four-ninths was carbon monoxide and five-ninths remained as carbonic acid; while at Dessau only 2 per cent. was carbon monoxide, the remaining 98 per cent. being carbonic acid only.

The superiority of the 5-metre retort for water-gas making is confirmed by line 30, Table I., and lines 8 and 9, Table II., where the increase in gross calorific power of the gas produced per pound of coal volatilized, due to steaming is at Mariendorf 870 B.Th.U.—viz., from 8274 to 9144, and at Zurich 85 B.Th.U.—viz., from 10,463 to 10,548. If the fuel expended in heating the retorts be brought in (line 31, Table I., and line 10, Table II.) the superiority of the former is maintained; and it appears probable that if the figures for tar and ammoniacal liquor production had been obtainable, this relative position would have been altered but slightly.

It has been stated above that the best comparison as to steaming is made by looking at the Zurich and Mariendorf results, because they relate to quantities of steam not very dissimilar. But another reason is the fact that the quantity of gas made and coal used in the several periods were separately ascertained there, while in the Dessau observations they are lacking. In the British report (see "JOURNAL" June 23, 1908, p. 808, column 1) it is stated that the estimated quantity of steam used at Dessau would be 409 lbs., and "this quantity of steam would, however, be nothing like all converted into water gas, as a good deal of it

TABLE I.

	Dessau.		Zurich.		Mariendorf.	
	No Steam.	Slightly Steamed.	No Steam.	Copiously Steamed.	No Steam.	Copiously Steamed.
1. Length of retorts, in feet	13·12	13·12	13·12	13·12	16·4	16·4
2. Coal carbonized per 24 hours, in tons	1·161	1·161	1·182	1·119	1·277	1·146
3. Gas produced per 24 hours each retort, in cubic feet	13,072	13,560	14,392	15,458	14,563	15,827
4. Do. per foot of retort, do.	996	1,033	1,097	1,178	888	965
5. Temperature of settings—(1) at the base	..	..	1336° C.	1378° C.	1288° C.	1302° C.
6. ,, ,, (2) higher level	..	..	1204° C.	1243° C.	1209° C.	1227° C.
7. Average of (1) and (2)	..	..	1267° C.	1310° C.	1248° C.	1264° C.
8. Range of (1) and (2)	..	..	126° C.	135° C.	79° C.	75° C.
9. Class of coal distilled	Unscreened New Pelton.		Saar.		Silesian.	
10. Gas made per ton of coal in cubic feet	11,259	11,680	12,180	13,820	11,400	13,810
11. Illuminating power in candles per 5 cubic feet	16·45	15·37	9 11	6·23	15·90	12·16
12. Do. per ton of coal	37,042	35,904	22,192	17,220	35,252	33,586
13. Gross calorific power, B.Th.U. per cubic foot of gas	604	596	591	561	585	537
14. Net ,, ,, ,, ,, ,,	543	535	526·60	500	523·50	481·20
15. Difference due to condensation of steam	61	61	64·40	61	61·50	55·80
16. ,, ,, ,, ,, per cent.	10·10	10·22	10·89	10 90	10·52	10·39
17. Gross calorific power, B.Th.U. per ton of coal	6,800,436	6,961,280	7,198,380	7,753,020	6,669,000	7,415,970
18. Net ,, ,, ,, ,, ,,	6,113,637	6,248,800	6,413,988	6,910,000	5,967,900	6,645,372
19. Difference due to condensation of steam	686,799	712,480	784,392	843,020	701,100	770,598
20. Coke produced, per cent.	..		69·3	67·2	64·04	63·78
21. ,, used as fuel ,, (*x*)	16·25		13·9	15·0	14 60	14·10
22. ,, for sale ,,	..		55·4	52·2	49·44	49·68
23. Matter volatilized ,, (*y*)	..		30·7	32·8	35·96	36·22
24. (*x* + *y*) including tar and liquor made	..		44 6	47·8	50·56	50·32
25. Coke produced per ton of coal	..		1552 lbs.	1505 lbs.	1434 lbs.	1429 lbs.
26. ,, used as fuel ,, ,, (x_1)	364 lbs.		311 ,,	336 ,,	327 ,,	316 ,,
27. ,, for sale ,, ,,	..		1241 ,,	1169 ,,	1107 ,,	1113 ,,
28 Matter volatilized ,, ,, (y_1)	..		688 ,,	735 ,,	806 ,,	811 ,,
29. ($x_1 + y_1$) including tar and liquor made	..		999 ,,	1071 ,,	1133 ,,	1127 ,,
30. Gross calorific power in gas per pound of (y_1)	..		10,463	10,548	8274	9144
31. ,, ,, ,, ,, ,, ($x_1 + y_1$)	..		7,206	7,239	5886	6580

TABLE II.—*Comparison of the Effect of Steaming.*

	Four-Metre Retorts at		Five-Metre Retorts at Mariendorf.
	Dessau.	Zurich.	
1. Decrease in illuminating power per ton of coal, candles	1,138	4,972	2,666
2. ,, ,, ,, ,, ,, per cent.	3·0	22·4	7·3
3. Increase in gross calorific power per ton of coal, B.Th.U.	160,844	554,640	746,970
4. ,, ,, ,, ,, ,, per cent.	2·3	7·7	11·2
5. ,, net ,, ,, ,, ,, B.Th.U.	135,163	496,012	677,472
6. ,, difference between gross and net calorific powers, B.Th.U.	25,681	58,628	69,498
7. Ratio of line 3 to line 6	6·26	9·46	10 75
8. Increase in gross calorific power per pound of coal volatilized, y_1, B.Th.U.	..	85	870
9. ,, ,, ,, ,, ,, ,, ,, per cent.	..	0·8	10·5
10. ,, ,, ,, ,, per pound of $x_1 + y_1$, per cent.	..	0·5	10·2
11. ,, ,, net ,, ,, per ton of coal, per cent.	2·2	7·7	11·4

would pass through the retort undecomposed." But later in the report a calculation is made of the amount of water gas produced, based upon the difference between the percentages of carbon monoxide in the coal gas and the mixed coal gas and water gas, which are stated as 5·72 and 6·87 respectively. From this, it is computed that 5240 cubic feet of water gas were made; but this is on the assumption that such gas had a content of 40 per cent. of carbon monoxide. Such an assumption would appear to be inconsistent with the former statement. The computations of the writer, based on the average of the analyses given in the report, indicate that rather less than one-half of the steam was acted upon by carbon, and what did so react gave a crude gas containing 12·66 per cent. of carbonic acid. In the absence of definite information as to the quantity of gas made and coal used during the steaming period, it appears somewhat hazardous to draw any inference from the analyses unless indeed the percentages of carbonic acid, carbon monoxide, and hydrogen in the unwashed gas be given. As the figures in the report refer to the purified gas only, these must be used to see whether the low ratio of 6·26, already shown in Table II., is confirmed on closer scrutiny.

From the details there given, the writer finds the following percentages by volume :—

	CO.	H_2.
Average of gas made with steam	6·870	57·670
,, ,, ,, ,, without steam	5·625	57·375
Rise due to steaming	1·245	0·295

The figure which agrees with the increased percentages of both gases (CO and H_2), is 4·33 per cent. of water gas having a composition, after purification, of 35·5 per cent. of carbon monoxide and 64·5 per cent. of hydrogen, or before purification 31 per cent. CO, 12·66 per cent. CO_2, and 56·33 per cent. H_2. These figures severally compare with 5·72 as the average percentage of CO in the coal gas alone, the calculated 3·6 per cent. increased volume due to water gas, and the assumed content of 40 per cent. of CO in the water gas. The new figures give 6308 cubic feet, against 5240 cubic feet—increase, 20·4 per cent. If this adjustment be correct, it means when applied to the figures in the report that the following are the results per ton of coal :—

Retorts at Dessau, May, 19 8.	Cubic Feet of Gas.	Candles.	Calorific Power in British Thermal Units.		
			Gross.	Net.	Difference.
With steam	11,735	36,073	6,994,060	6,278,225	715,835
Without steam	11,228	36,940	6,781,712	6,096,804	684,908
Difference due to steaming	507	867	212,348	181,421	30,927

The loss in candle power equals 2·3 per cent., while the gain in calorific power is 3·2 gross per cent. and 2·98 net per cent. The ratio $\frac{212,348}{30,927} = 6·9$.

It appears that even this improved ratio may underestimate the efficiency of the working that took place at Dessau; for if the proportions of the gases generated are those already given by the writer, then notwithstanding the 12·66 per cent. of carbon dioxide therein, the ratio ought to be 9·48, or practically the same as at Zurich. It should be observed that any steam passed through the fuel which is undecomposed thereby, does not enter into this reckoning, although it might act prejudicially in lowering the temperature of the retort for the next charge of coal. The explanation of the disparity between the 6·9 and 9·48 ratios is probably to be found in the uncertainties (more than once referred to) which attach to the three periods—non-steaming, steaming, and non-steaming, the figures for which probably overlap.

In the "JOURNAL" for the 18th ult., we gave the names of two of the employees of the South Metropolitan Gas Company who were prize-winners at the last gas examinations. We learn from the current number of the "Co-Partnership Journal" that another —Mr. W. Carter, of the Old Kent Road—passed second class in "Gas Engineering."

ROUND THE WORLD—AND SOME GAS-WORKS.

By Maurice Graham.

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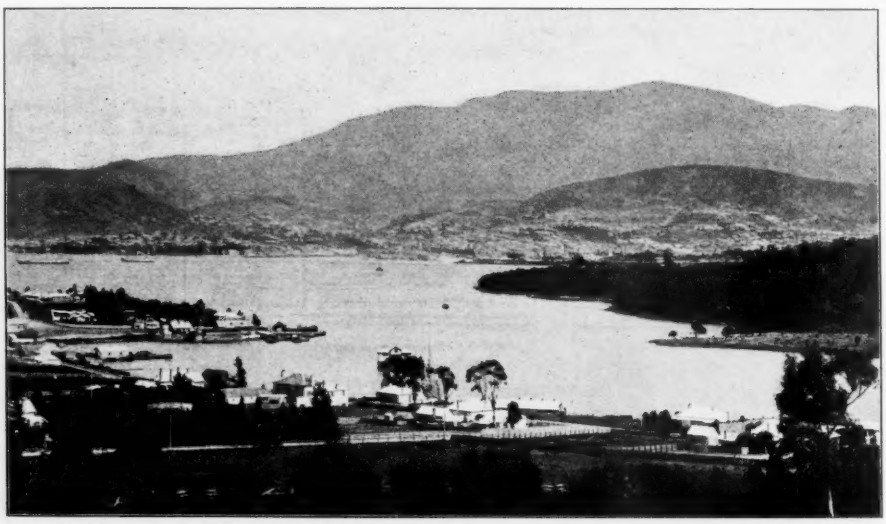
IX.—TO THE GAS-WORKS FARTHEST SOUTH.

Nothing interesting happened on the voyage from Melbourne, on the s.s. "Moerake"—one of the beautiful and comfortable boats of the Union Steam Ship Company of New Zealand. Praise must be given for the general management of these boats; their equipment and service being excellent, and better than that of the P. and O. line, the methods of which are too autocratic and conservative. It was a rather rough passage throughout the 460 miles from Melbourne until the entrance to the River Derwent was reached. Twelve miles further up is the City of Hobart, the capital of Tasmania.

HOBART, TASMANIA.

The river widens out and forms near the City a bay which is large enough to take a naval fleet, and the waters of which are deep enough for vessels of any size, even the biggest battleship. A good general view of the bay and the City of Hobart, with the gas-works clearly to be seen in the centre, can be got from Photograph No. 80. The population is about 37,000. Electric tramways, a splendid water supply, electric light and gas, all help to



Photograph No. 80.—General View of Hobart City and Bay—The Gas-Works can be seen near the Centre.

make the town up to date. The public buildings, including the Government House (a handsome structure of white freestone situated in wooded grounds overlooking the stretch of water), Parliament House, the elegantly built Customs House on the Quay, the Tasmanian University, and the General Post Office—all built of freestone and surrounded by neatly trimmed shrubberies—make Hobart a beautiful and dignified city.

A letter of introduction to Mr. W. J. Campbell, the Secretary and Manager of the Hobart Gas Company, considerably lightened the difficulties of the writer. A tour through the works, the yard of which is illustrated in Photograph No. 81, showed regenerative furnaces giving excellent results; retorts charged by scoop suspended from light overhead traveller; and the drawing done by hand. Each bed has a separate and large hydraulic main; there being at the end of the bench a tar tower regulating the seal. The results are: 11,676 cubic feet of gas made per ton and 8¼ cwt. of coke sold per ton of coal carbonized—and good clean coke it is, too. Extensions will shortly be made on similar lines to those described, and thus do away altogether with direct fires, or "fuel wasters."

The condensers (which can be seen in Photograph No. 81) are on the annular pattern and next to the retort-house. Then comes the exhauster house, where two exhausters with cone-regulators are driven by gas-engines; next, a washer-scrubber and a Livesey washer, each of 250,000 cubic feet capacity. Across the yard, is the large purifier house, a complete steel structure with wood and corrugated covering so as to be readily removed in the summer. The roof covers the four larger boxes, 25 feet by 20 feet, while the four smaller ones, 12 feet square, are placed close by in the open. The governor and valve house is the "show" place inside the works, and is well arranged in the space formerly occupied by an old purifier house. There are two station meters and two gasholders (single lifts) in the gas-works proper; but there is a stately telescopic holder, 135 feet diameter, prepared for three lifts, situated in a beautifully wooded compound outside the yard. The total capacity of the gasholders is 672,000 cubic feet, or over double the greatest make of gas per 24 hours, which is 320,000 cubic feet.

A Splendid Show-Room.

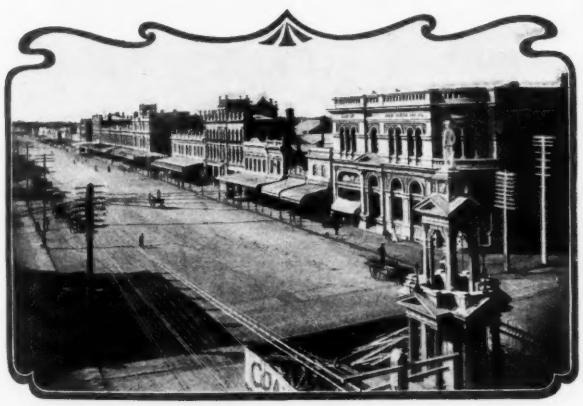
Mr. Campbell showed the writer through the workshops and repairing shops. They are well equipped for doing all their own

Photograph No. 81.—Hobart Gas-Works' Yard.

Photograph No. 82.—The Show-Room.

work, as they cannot afford to wait for Melbourne goods, which take a two days' journey. The show-room (illustrated in Photograph No. 82) is above the offices, and does the management very great credit. Every latest apparatus is noted and introduced, if it will increase the Company's business. Although some 12,000 miles away from Old England, the equipment and organization of this department would astonish the average English gas manager. Not content with so fine a show-room, where the politest attention is meted out to all customers, there is a well fitted up shop in the main street. There a lady lecturer is in attendance, who answers any questions and affords advice about gas cookers, &c. Fortnightly demonstrations are given in the Town Hall, and these are largely attended. Special terms for gas cooking accounts are allowed; the price being 5s. 5d. instead of 6s. 8d., as it is for lighting. Thus the sale of gas is pushed in competition with coal and wood, which are largely used. The cookers are fixed and kept in order free of charge.

The inside lighting generally is by inverted incandescent gas-burners. The outdoor illumination in the suburbs is also by incandescent gas. But the central portion of the City and the public buildings are lighted by electricity. As will be gathered from Photograph No. 83, the Hobart Gas Company are also



Photograph No. 84.—The Main Street of Invercargill, New Zealand.

suppliers of electric light. Being thoroughly up-to-date in their business methods, the broad-minded and influential local Directors determined that there should be no cut-throat policy between gas and electric lighting. They, therefore, made their Company into a producer of both illuminants, and supply whichever the customer wants, or both if he wishes. The last balance-sheet, however (for the half year ending Dec. 31, 1907), shows that the sales of gas are much greater than those for electric light; the former realizing £13,118, as compared with £2547 for the latter. None the less, if a few more companies had done the same—that is supplied both gas and electricity—there would have been greater satisfaction to-day and less wasted capital.

Views on Commercialism.

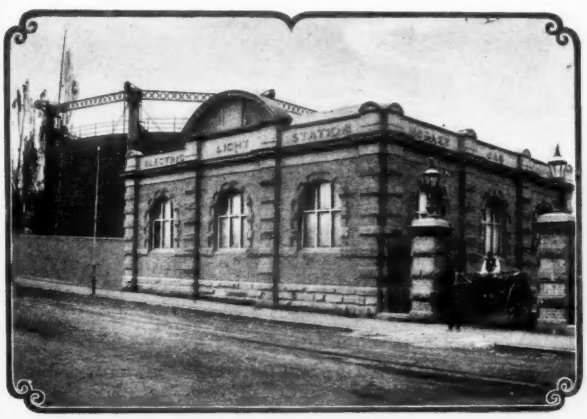
So, too, it must be realized that a gas manager should be 90 per cent. a commercial man and 10 per cent. an engineer. There is far too much time given to discussing whether the next retort-house walls should be 2 ft. 3 in. or 2 ft. 6 in. thick, or to finding some new complicated way (which will puzzle creation) of getting a few more feet of gas per ton. Such time should be given to pushing the sale of gas, and to giving special attention to the method of burning gas by using the right burners, so as to ensure that the consumers shall get the best light for their money —whether they want it or not. However, the Hobart Gas Company do not suffer in this way; for everything that can be done by facilitating inquiry, increasing knowledge, and advertising the uses of gas, is done; and the result is a 6¼ per cent. increase on an annual make of over 90 million cubic feet.

Only last year the Company celebrated their jubilee, having been first established in 1857. Mr. Campbell has been 27 years in the Company's service. He was born in the town, and trained there in sound business methods. The writer is greatly indebted to him for the courtesy and kindness extended, and for the interest he took in so willingly giving so much information. Photographs and other particulars were also freely supplied, and full acknowledgment of them is here made. With all good wishes, the writer passed on to visit New Zealand.

Very soon after leaving Hobart, rough and squally weather was experienced; the gale became worse and passengers were glad to land (after their 900 mile journey) at The Bluff, the southernmost point of South Island, New Zealand. From there, 17 miles of wet swampy country is passed through by rail, and Invercargill is reached.

Invercargill, New Zealand.

It is a prosperous little town in the Southland district of the South Island (sometimes called Middle Island), New Zealand.



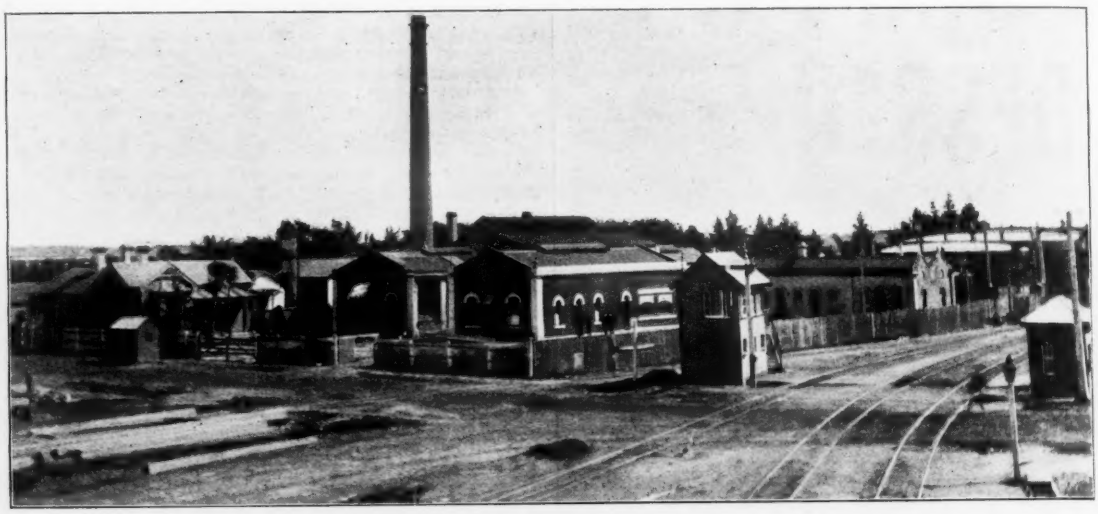
Photograph No. 83.—Gas and Electricity.—The Electric Light Station of the Hobart Gas Company.

The population is about 13,000; and it is the concentrating point of five railways. It is the centre of a large agricultural and pastoral country, the chief products of which are cereals. Coal and lignite are also found. It contains some splendid buildings which are arranged at varying distances down the main streets, so as to allow of and encourage future development. A good view of the main street is given in Photograph No. 84. The banks are specially fine; and the Government buildings are on a scale not often seen in a town of the same size. The buildings are all of brick, concrete, or limestone. The Corporation provide both water and gas. The water tower (Photograph No. 85) is a conspicuous landmark, and is built of brick. To the tank at the top of it is pumped artesian-well water, from which most of the houses are supplied.

The Gas-Works Farthest South.

Invercargill's Gas-Works have the distinction of being the most southern gas-works in the world. A general view of them is shown in Photograph 86. They are situated near the railway station, and convenient for railway connection with the yard and coal stores. Mr. G. Rabbidge, who is Engineer and Manager, has only held the position for some twelve months, as he followed

Photograph No. 85.—The Invercargill Water-Tower.



Photograph No. 86.—The Gas-Works Farthest South—Invercargill.

Mr. Hawkins, who retired after sixteen years' service. The first thing Mr. Rabbidge did was to make out a full and accurate report of how matters stood—especially as regarded the efficiency of the plant and the state of the works. This report is a lucid description of the condition and necessities of the works. The compiler of it was fully qualified for the task by his large practical experience in draughtsmanship and constructional work at the Auckland, Paeroa, and Waihi Gas-Works, New Zealand. The present writer found Mr. Rabbidge hard at work in his drawing office upon his new extensions, and could at once detect the able and experienced mind and hand. The Corporation of Invercargill are to be congratulated on having obtained such an excellent officer, who thoroughly understands what he is doing and why he is doing it.

The works being in a complete state of dismantling and re-erection, the writer can only say a few words as regards his walk round them. Having seen a sample of the old retort-house, with dirt and patched pipes and pitch all over the place, he wondered how on earth Mr. Rabbidge had been able to get through the previous year's make of 40 millions. The new retort-house is substantially built in brick, and will contain ten beds of six retorts each, 10 feet long, and heated by deep regenerative furnaces. There is scoop-charging with manual drawing. The adjacent coal-stores hold 1000 tons of coal, brought by ship from Newcastle, N.S.W. The foul-main carries the gas to five annular condensing tubes, 2 ft. 6 in. inner diameter and 25 feet high. The two new Bryan-Donkin exhausters and engines will make a nice little arrangement, and be a great contrast to the former apparatus with only one 5-inch diameter pipe for the gas to go through. So, too, with the washer and scrubber, which were being renovated and put in order, as formerly the gas would not pass through them. There are four purifiers, 12 feet square, two with water-sealed and two with dry covers. The oxide of iron which is used in them is obtained from fields near the works. Formerly lime only was used.

Of the three gasholders (the capacity of which is 212,000 cubic feet), one telescopic holder is guided on Pease's wire-rope system. It is 80 feet diameter by 25 feet deep. The other two holders are single lifts.

The roof for the new retort-house was made, and any other steel work required is done, in the town from Mr. Rabbidge's details. Spiral rivetted steel pipes are also largely used. These are made in Wanganui, N.Z., and look very serviceable.

The manager's office was formerly a cubicle in a blacksmith's shop—9 ft. by 7 ft. by 8 ft. high.

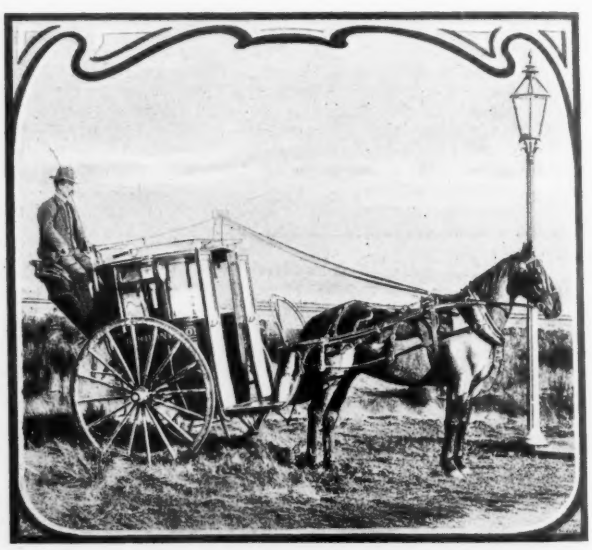
From what has been said it will not be wondered that the manager's report condemned "the present plant and system as obsolete, unprofitable, and quite inadequate for the present and future requirements of Invercargill," and contained a strong recommendation to reconstruct the whole plant on modern lines. This is now [March] being done; and when the winter comes on —in June, July, and August—there will not be so much cause for anxiety, as the new plant will be fixed ready for its first winter's work.

The public lighting is done by incandescent gas; and next year mantle maintenance will be in force. Perhaps the most interesting item in connection with the outdoor illumination is shown in Photograph No. 87. It is the most southern gas lamp in the world. Two men on horseback used to ride round to light up and and extinguish the public lamps; but other arrangements are now made.

Slot meters are not much pushed by the Corporation, as the inhabitants of Invercargill proudly resent the implication of possible arrears in the payment of their gas bills.

A new office in the town, with show-room, will afford facilities to the public, and put before them (as the report has it) "the innumerable appliances for the use of gas for business, domestic, or industrial purposes."

The writer left Invercargill with pleasing recollections of the pleasantness and courtesy of the Engineer and Manager of the "Gas-Works Farthest South."



Photograph No. 87.—The Most Southern Gas-Lamp (and Hansom Cab) in the World.

Estimation of Sulphur in Coal.

A rapid method of estimating the total sulphur in coal was described by Herr A. Komarowsky in the "Chemiker Zeitung" for the 12th ult. According to an abstract of the article in the "Chemical Trade Journal," he burns the coal, mixed with cobalt oxide and sodium carbonate, in a current of oxygen after the manner of Brunck, and estimates the sodium sulphate volumetrically by a modification of Andrews' barium chromate method. One gramme of the powdered coal is mixed with 2 grammes of a mixture of 2 parts of cobalt oxide (prepared by heating the nitrate short of redness) and 1 part of dry sodium carbonate, and the whole put in a boat which is placed in a wide glass tube about a foot long and open at one end, while the other is connected to a supply of oxygen. A small flame brought under the boat starts the combustion, after which no external heating is required until towards the end of the process, which occupies not more than 15 minutes. When cool, the boat is tipped into a funnel placed in the neck of a flask, and its contents washed into the flask with hot water. A few cubic centimetres of hydrogen peroxide are added, and the mixture is boiled for two or three minutes, after which it is neutralized with hydrochloric acid, and then transferred to a 200 c.c. measuring-flask, cooled, made up to the mark, and filtered. To 150 c.c. of the filtrate, 1 c.c. of 10 per cent. hydrochloric acid is added, and then 5 c.c. of barium chromate cream. After boiling for five minutes, the liquid is cooled, neutralized with ammonia, and filtered from barium chromate and sulphate. To the filtrate, which now contains chromate equivalent (acidimetrically) to the sulphate derived from the sulphur in 0·75 gramme of coal, a crystal of potassium iodide is added, and the liberated iodine titrated with sodium thiosulphate. Results by the method are stated to agree well with those obtained by Eschka's method, and where they disagree Herr Komarowsky prefers his own.

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This System has been adopted at the following Places:—

	Number of Retorts.		Number of Retorts.
Barcelona	150	Hamburg—Grasbrook	50
Cologne	240	Aschaffenburg	8
Dortmund	100	Halle a/d.S.	60
Duisburg	50	Dessau	60
Sölingen	30	Potsdam	48
Ludwigshafen	30	Berlin—Oberspree	48
Zürich	100	Berlin—Mariendorf	84
Düsseldorf	70	Berlin—Tegel	10
Offenbach	80	Chemnitz	60
Brandenburg a/H.	60	Worms	30
Trieste	20	Potsdam (Repeat Order)	40
Elberfeld	120	Mariendorf (Repeat Order)	72
Frankfort—Bockenheim	120	Charlottenburg	70
Genoa	60	City of Berlin—Danzigerstrasse	240
Magdeburg	80	City of Berlin—Schmargendorf	80

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SIMPLEST, SAFEST, CHEAPEST, AND BEST SAFETY AIR-GAS APPARATUS.

A Pure, Wholesome, Non-Explosive, Non-Suffocating Gas

At 1s. per 1000 cubic feet.

Consumes about 4 feet = 30 candles per hour, 10 feet = 100 candles per hour.

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40 ,, ..	£47
100 ,, ..	£120
200 ,, ..	£175
400 ,, ..	£250

SECOND TO NONE!

Another Big Advance in Gas-Fire Development.

We have this season introduced two new fires, which embody the very latest inventions in up-to-date Gas-Fire Construction, and are among the most effective stoves ever placed on the market.

THE "SARACEN," Panel Fire.
THE 14-in "RADIUM," Slot Gas Fire.

These stoves are fitted with the Patent "Thermo" Firefront—a new invention by which the metal fuel-guard is entirely done away with, and effective radiation is enormously increased.

The "SARACEN."

Patent "Thermo."
Patent Removable Brick and Burner.
Patent Gas Adjuster.
Patent Air Adjuster.

A High-Grade Fire at a Low-Grade Price.

The "Saracen" is an entirely new type of stove, whose extreme utility, and exceptionally quiet, yet artistic, design, cannot fail to commend it to all classes of consumers.

	610	614
Height	27 in.	30 in.
Width	19 ,,	23 ,,
Width of Fire	10 ,,	14 ,,
Height—Floor to top of Flue	19 ,,	21 ,,
Diameter of Flue	4 ,,	5 ,,
Prices—		
Best Black Finish	37s. 6d.	50s.
Armour Bright Finish ..	58s. 6d.	75s.
Porcelain Enamelled ..	53s. 6d.	75s.

The Stove with the Reputation.

Our earlier sizes of the "Radium" have commanded such wide popularity that we have this season extended the list by adding a new "Radium" with 14-in. fire, having the new Patent "Thermo" Firefront and Duplex Burner, with the new "Simplex" Gas and Air Adjustment.

	314
Height	31 in.
Width	24 ,,
Width of Fire	14 ,,
Height—Floor to top of Flue.. ..	21 ,,
Diameter of Flue	10 ,,
Prices—	
Best Black Finish	39s.
Armour Bright	64s.
Porcelain enamelled	64s.

Extras—*See New Booklet.*

The "RADIUM."

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Patent Gas Adjuster.
Patent Air Adjuster.

The "Saracen" and the new 14-in. "Radium" Stoves mean a large increase of business to those Gas Authorities who add them to their lists.

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A GAS COMMISSION AND ITS RULINGS.

From a PHILADELPHIA CORRESPONDENT.

WHEN it became known last year that the State of Wisconsin had entrusted to its Railroad Commission the enforcement of the "Public Utilities Law," there was a feeling of satisfaction among the companies to be affected by the law, for the three men composing the Commission had by their dealings with the railroads obtained a reputation for breadth of mind and fairness in judgment. Each month since then has but given additional proof that the confidence thus felt was not misplaced, as will be shown by an account of the Commission's actions in gas affairs.

The first step taken was an investigation of the existing conditions of gas supply throughout Wisconsin. The propriety of such an investigation as a first step before making any regulations is, of course, obvious to any logical mind; but unfortunately for our public utility companies in this country, there have been other Commissions who seemed willing to regulate conditions of which they were quite ignorant.

To quote the Commission, these investigations covered the following lines:—

I.—GENERAL.

1. Requirements already in force in various states, countries, and cities.
2. Equipment and methods employed in carrying out the above requirements.
3. Special conditions affecting quality of service embodied in contracts between generating companies and operating companies or consumers.
4. Comparison of requirements for satisfactory operation of lighting devices with those of heating and power devices.
5. Conferences and interviews with manufacturers, operators, consumers, and authorities, both within and outside the state of Wisconsin.
6. Examination of the records of public service companies to determine condition in which meters have been found, tests made, and service records kept.
7. Reviews of technical literature and the proceedings of various technical societies relative to gas service.
8. Co-operative action with the United States Bureau of Standards and the Committee on Standards of the Amer can Gas Institute in fixing standards of service tests.
9. Conference with the authorities of the University of Wisconsin leading to the establishment of a central testing laboratory for the control of service in Wisconsin.

II.—METER ACCURACY.

1. Investigation of equipment and methods employed by various companies in conducting tests of gas-meters.
2. Tests of gas-meters to determine the accuracy of registration now being maintained.
3. Study of the various makes and types of gas-meters now on the market, with special respect to accuracy of registration.
4. Study of the various makes and types of portable testing instruments.
5. Local conditions affecting the accuracy of registration of gas-meters.

III.—VARIATIONS IN PRESSURE.

1. Continuous records and instantaneous readings of gas pressure taken at various times and at various locations on several distribution systems.
2. Study of the load conditions affecting the general operation and regulation of lighting systems.

IV.—INTERRUPTIONS.

1. Compilations of data as to interruptions in service, their duration and causes in various Wisconsin cities.

V.—GAS.

1. Study of the relative importance of photometric standards and calorific standards in fixing requirements for quality of gas.
2. Tests to determine the calorific value of gas as furnished by nearly all of the gas companies in the state.
3. Study of efficiency of gas-burners as regards adjustment, efficient mixture and general design.
4. Study of the various makes and types of calorimeters on the market.
5. Adequacy of house piping.

VI.—FIELD STUDY OF OPERATING CONDITIONS OF GAS PLANTS IN WISCONSIN.

1. The inspectors have examined the accuracy of gas-meters in seven cities.
2. Gas pressure records have been secured in six cities, and calorimetric tests of gas have been made at twenty-one of the plants operating in Wisconsin.

After the investigation had progressed far enough to enable the Commission to formulate a programme for discussion, it invited the representatives of the gas companies and also various gas engineers from other sections of the country to a conference; and the Commission expresses its hearty appreciation of the valuable aid received through the conference and from the various experts who participated in it.

As a result of the conference, the Commission issued on July 24 their pamphlet "U. 21," from which previous and subsequent quotations in this article are taken. It is entitled "In Re Standards for Gas and Electric Service in the State of Wisconsin." Extracts will best illustrate the spirit in which the Commission does its work—

> If any management anticipate or experiences difficulty in complying fully with such rules and regulations, it is expected that application for a modification of the rule or rules with regard to which difficulties are encountered will be made to the Commission; but until a modification of any rule or regulation herein prescribed has been expressly authorized by the Commission, the gas companies . . . will be expected to comply strictly with the terms of every rule and regulation ordered herein. It is possible that certain plants are operated under conditions which make it impracticable or not the best interest of the public to meet all the requirements of all the rules. Under such conditions it devolves upon the utility to show to the Commission, by complete and convincing evidence, that a modification of some rule or rules should be made. Suggestions and criticisms are at all times welcomed by the Commission.

Surely these are fair words. Then follow some remarks about gas service.

> Adequate service is not necessarily the best service which it is possible to give, but rather the best service which can be given with due regard to economy to the consumer and to the company. The kind of service prescribed should not be materially different from that furnished by companies operated under the best management and giving the best service. There may be certain conditions surrounding the gas industry in this state which make it desirable to prescribe certain standards which may not necessarily be the best standards in other states where the conditions may be different. *The gas companies themselves should conduct all tests, so far as practicable, and take care of all complaints of service in the same manner that complaints are being taken care of by companies under the best management.*

The words italicized furnish a key to an understanding of the Commission's attitude—viz., it believes in the least possible interference with the management of any company.

The unwillingness of the Commission to go ahead without being sure of its ground is thus shown:

> It is not believed desirable at this time to prescribe the exact specifications and details for the methods of making the various tests, since further investigation will be necessary before the best methods can be determined. It is impossible, for example, to make satisfactory recommendations as to which of the various types of calorimeters available will serve most satisfactorily for determining the heating value of commercial gas sold for heat, light, and power purposes. An investigation of the properties of the various calorimeters is now being carried on by a Committee of the American Gas Institute, with which Committee certain members of the engineering staff of the Commission are co-operating.

The Commission considers adequacy of service under the following heads: Accuracy of Meters; Heating Value; Candle Power; Gas Pressure; Purity of Gas. Under the first head is given:

> Rule 1.—Any meter may be considered as correct if, when passing gas at the rate of 6 cubic feet per hour per light capacity, it shows, in comparison with a standard gas prover, an error which is not greater than 2 per cent.

It justifies the 2 per cent. variation by the statement that errors in proving may amount to 1 per cent.; and an additional 1 per cent. is allowed for any change occurring in the meter after being set. Under the Wisconsin ruling, all meters testing within 2 per cent. limits are, of course, recorded as correct. In New York, on the other hand, the law provides no lee-way; and, in consequence, any meter not correct or slow is fast—to the great delight of the "yellow" journals, who hasten to spread before the readers the fast meters in the monthly report of the New York Commission, carefully concealing how small may be the errors.

The Wisconsin Commission from their tests of meters taken from service, and from the opinion expressed by some of the gas engineers at the conference, decided on a maximum interval between meter tests as in—

> Rule 2.—No gas company shall allow a gas-meter to remain in service for a period longer than three years without checking it for accuracy and readjusting it if found to be inaccurate.

This rule expresses what has been the practice of the best-managed gas companies in the country up to the present time. Several years ago, however (as recently mentioned in your columns), the Philadelphia Gas-Works, which had been removing its meters for test after three years' service, found such a large percentage of them accurate in registration and perfect in condition, that it was decided to adopt the practice of not removing a meter until the gas measured by it decreased 25 per cent. compared with the corresponding quarter of the previous year, and by observation at the house it was found that the test-hand did not show any movement while a small flame was burning. It is believed that this practice has resulted in saving much money to the company and annoyance to the consumer; and while, of course, there may be a few fast meters left in service, the use of dipping diaphragms has made this trouble negligible. It is to be expected that if similar conditions develop in Wisconsin, similar profit will be derived from the records obtained under—

> Rule 3.—Each company shall keep a record of tests made on meters before installation and upon receiving them from the service.

Other rules as to meters are as follows:—

> Rule 4.—Each gas company shall provide itself with equipment necessary for testing meters, such equipment to consist of a standard meter prover with suitable accessories.

Rule 5.—Each company shall make a test of the accuracy of a meter upon request of a consumer, provided such consumer does not make a request for test more frequently than once in six months. A report giving the results of such tests shall be made to the consumer; and a complete record of such tests shall be on file in the office of the company.

Rule 6.—Upon formal application of any consumer to the Railroad Commission, a test shall be made upon the consumer's meter by an inspector employed by the Railroad Commission, such test to be made as soon as practicable after receipt of the application. For such test, a fee of two dollars ($2·00) shall be paid by the consumer making application for the test, if the meter is found to be slow or correct within the allowable limits, and by the company owning the meter if the meter is found to be fast beyond the allowable limits.

Rule 7.—Meter-dials shall read directly in cubic feet of gas, and bills rendered periodically by the company shall designate the readings of the meter at the beginning and end of the time for which the bill is rendered, and give the dates at which the readings were taken.

Some omissions are very important; and it is to be especially noted that the Wisconsin Commission carefully refrain from prescribing a Commission test of all new meters or repaired meters before being placed in service. Such a test is made obligatory by the New York law; and as it is now costing the taxpayers thousands of dollars yearly, it is to be hoped that the New York Commission will soon be convinced of the folly of this testing and recommend legislation necessary to abolish it.

The Commission's remarks and rules concerning heating value mark such a change from current practice as to warrant quoting in their entirety—

> Under conditions governing the use of gas in Wisconsin, it appears that by far the largest amount is used for purposes such that its heating value is a measure of the serviceable value of the gas. There is a small percentage of gas consumption, believed to be materially under 10 per cent., which is used in open-flame burners, and in which the candle power is a measure of its value. Since the gas so used is but a small percentage of the total, and this percentage is continually decreasing—due to the increasing use of incandescent mantles—it appears that a calorific standard may be of far greater service than is the commonly used candle power standard.
>
> The common method of expressing the heating value of a gas is in the number of "British Thermal Units," generally abbreviated "B.Th.U.," developed upon the combustion of 1 cubic foot of gas, as measured under standard conditions of temperature and pressure. Some authorities prefer to express the heating value of a gas as the so-called "net heating value," which is obtained by subtracting from the total number of heat units liberated, the heat units which are liberated by the water formed in the products of combustion in cooling from vapour at the boiling point to water at the temperature to which the products of combustion are cooled. It is true that for most purposes to which gas is applied, this latent heat of the water of combustion does not become available; but there are other uses to which the gas is put in which this heat becomes useful. There are few, if any, gas-consuming devices in commercial use which utilize all the heat which is measured on a standard calorimeter; the percentage of loss depending upon the temperature at which the products of combustion escape. It appears, then, that, for purposes of standardizing a gas in such a way as to avoid bringing into consideration the kind of burner in which it is employed and the purpose for which it is used, the standard should specify the total heat which is liberated by the gas. Consequently the total heat value (sometimes called "gross value") is recommended as the standard.
>
> In general, it may be stated that, other things being equal, that gas is of the greatest value which has the greatest number of heat units per cubic foot, and it is possible to obtain a gas which has 800 (or more) B.Th.U. per cubic foot. Such a gas is more costly, however, to the consumer, on account of the disproportionate expense of securing the high heating value. It is believed that the heating value standard adopted should be that value which will give satisfactory service in the forms of appliances commercially in use, and that it shall be such value as may enable gas to be sold at the most reasonable cost to the consumer. A value of 600 B.Th.U. per cubic foot is believed to meet these requirements fairly well. Records of tests made upon various plants in this state show a range of heating values between the limits of 193 and 1050 B.Th.U. per cubic foot; the majority of tests showing a value of about 600. The large proportion of the gas made in this state is what is known as coal gas, produced by the distillation of coal in retorts. It is possible, by the use of a good grade of coal, and by the exercise of good management, to secure a heating value of about 600 B.Th.U. Plain water gas has a much lower value, which is usually raised by oil enrichment to 600 B.Th.U. or upward.
>
> The heating value of a gas decreases to some extent with the distance that it is transmitted. This is due to condensation of some of the constituents, and is especially marked in cold weather. In prescribing the standard of gas, therefore, it should be specified that the test is to be made within a certain distance of the centre of distribution; and one mile is suggested as a satisfactory distance. It is desirable not only that the heating value be maintained above a certain amount, but that it should not be allowed to vary from this amount through too wide a range, since a gas which fluctuates greatly is almost as unsatisfactory as one which has an abnormally low heating value. A certain range of variation is necessary on account of the varying conditions met with in gas plant management.

The following regulation is suggested as providing for adequate gas service from the standpoint of heating value:—

Rule 8.—The company furnishing gas which, within one mile radius from the distribution centre, gives a monthly average total heating value of not less that 600 B.Th.U., with a minimum which shall never fall below 550 B.Th.U., may be considered as giving adequate service as far as the heating value of the gas is concerned.

Rule 9.—Each gas company, whose output exceeds 20 million cubic feet per year, shall equip itself with a standard calorimeter outfit, with which periodic tests upon the gas shall be made. A record of these tests shall be made, and kept open for public inspection.

The remarks on candle power deserve the attention of those municipal bodies everywhere, whose habit it has been to harry gas companies with unreasonable demands in this direction—

> For the reasons previously outlined, it appears that the candle power standard which has been almost universally used in the past for gas measurements, is of minor importance in this state. It is possible to secure a high candle power gas which has but a moderate heating value; and to require companies to maintain a double standard which shall insure both the high heating value and a high candle power, would surround them with such restrictions that economy in manufacture might not be attained. And since but few consumers would be benefited by candle power restrictions, and with this number continually decreasing, no regulations as to candle power are prescribed at this time. It should be added, however, that with a 600 B.Th.U. heating standard, and in view of the conditions under which gas is being manufactured in this state, a fairly satisfactory illuminating value is ensured. It is hardly possible to manufacture a coal gas of 600 B.Th.U. which shall not have a candle power from 12 to 16 or even more. The enrichment of a water gas up to 600 B.Th.U. will insure an even higher candle power.

The regulations concerning pressure were, of course, of vital interest to all the companies. After the asinine performance of the New York Legislature in enacting pressure regulations for New York City, compliance with which was impossible from topographical as well as underground street conditions, but which, once enacted, forced the gas companies into expensive litigation, the worst might be feared, except for the saving fact of the *personnel* of this Wisconsin Commission. The result, as shown in the rules below, will, it is hoped, serve as a guide to all future regulation in this country.

Rule 10.—Gas pressure, as measured at meter inlets, shall never be less than 1½ inches nor more than 6 inches of water pressure; and the daily variation of pressure at the inlet of any one meter on the system shall never be greater than 100 per cent. of the minimum pressure.

Rule 11.—Each company shall make frequent measurements of the pressure and pressure variations, and these shall be kept on record and open for public inspection.

Concerning purity of gas, it will be noted that the Commission is not willing to waive the presence of sulphur.

Rule 12.—In no case shall the gas contain more than 30 grains of total sulphur per 1000 cubic feet, and not more than a trace of sulphur as sulphuretted hydrogen.

True to its principle, not to interfere unless there is some reason, the Commission hopes by its last rule to receive reports that will warrant commendation and not investigation.

Rule 13.—Each company shall keep a record of complaints, which shall include the name and address of the consumer, the date, the nature of the complaint, and the remedy. A classified summary of these records shall be submitted to the Commission on or before the twenty-eighth day of each month for the preceding month.

Competition of Electricity with Gas.

The returns just issued by the Board of Trade in regard to the gas undertakings of the United Kingdom, which are noticed elsewhere, afford ample proof that the use of electricity for lighting purposes has not, up to the present, caused a diminution in the consumption of gas. Continental experience, according to the "Westminster Gazette," would appear to be somewhat similar. "There, as here," says our evening contemporary, "the invention of the glow lamp led to many dismal prophecies regarding the future of gas; but, thanks to the various improvements in burners, and especially the success of the incandescent gas-mantle, electricity has had a hard struggle to get the better of its old rival. Statistics show that both systems have flourished side by side. In 1889 there were in Paris less than 500 arc lights and about 19,000 glow lamps at work. In 1905 these figures had grown to about 17,000 and 1,500,000 respectively. So, too, the gas consumption of the city has jumped from 270 million cubic metres in 1897 to 350 millions last year—an increase of 30 per cent., in spite of the rapid development of electric light. Italy presents still more striking proof of healthy competition between the rival systems. In Rome the gas consumption has risen in ten years from 14 to 20 million cubic metres; while for Milan the corresponding figures are 24 and 53 millions. At the same time, the number of electric lamps has increased in Rome from 51,000 to 214,000, and in Milan from 27,000 to nearly 250,000."

Mr. Daniel Macfie, formerly Managing-Director for Messrs. James Milne and Son, Limited, has resumed business at No. 1, North St. Andrew Street, Edinburgh, as a specialist in gas and water appliances and metal work in all departments. He also represents Messrs. Alexander Wright and Co., makers of gas and steam testing apparatus; Mr. George Wilson, manufacturer of gas-meters, Coventry; and Messrs. Kerr and Co., pipe-founders,

NEW INVERTED COMPANY'S NOVELTIES.

REFERENCE to the new season's catalogue of the New Inverted Incandescent Gas-Lamp Company, Limited (which has just been issued), or, better still, a visit to their extensive show-rooms at Nos. 19 and 23, Farringdon Avenue, E.C., will show they are always on the alert in making improvements. The "Nico" inverted burner with porcelain cone is, of course, well known; and an innovation for the present season has been made in respect of the No. 4 burner, which is now being fitted with a smaller porcelain cone (see fig. 1), which gives it a much neater appearance. In point of efficiency and durability, we feel sure this burner can be recommended, especially when used with what has now become such a popular feature, the "Nico" gas-regulator.

Fig. 1—No. 4 Burner, with Small Porcelain Cone.

For those who prefer inverted burners on the self-intensifying principle, the Company have introduced a new feature in the form of a lamp of this type made with a porcelain body (see fig. 2). This lamp is claimed to be highly efficient; and it has a very cleanly and smart appearance, being made in white porcelain with either gold or olive green decoration in the "Empire" style. Moreover, it is made to take the ordinary bell-shaped inner cylinders and standard fitting globes. In addition, the Company are putting on the market an intermediate sized burner on the self-intensifying principle, known as the Bijou "Nico-Intense" (see fig. 3); and they have every confidence that this will become a favourite burner for domestic lighting, as it is very neat in appearance and gives a light of 70-candle power for a gas consumption of $2\frac{1}{2}$ cubic feet. This burner is made in the usual polished brass and black bronzed finishes, and also in white enamel with gold lines. The Company's "Nico" arc lamps have now become a popular feature, and can be had fitted with screens for advertising purposes for outside shop lighting. In addition to the efficiency of the "Nico" arc lamps, they have two specially good features—one being that the body is easily opened for access to the burners for regulating and other purposes, and the other that no inner glass chimneys are needed for use with these lamps. Any notice of the Company's specialities will not be complete without some reference to the "Nico" desk light, which consists of a "Nico" Bijou burner mounted (as shown in fig. 4) on a universal joint, and fitted with an enamelled iron shade. The burner can be set at any angle, as well as moved round in a circle, thus enabling a sufficiency of light for any purpose to be projected just on the spot where it is required. Accidental overturning is guarded against by heavy weighting of the pedestal.

Fig. 2.—"Nico-Intense," in White Porcelain.

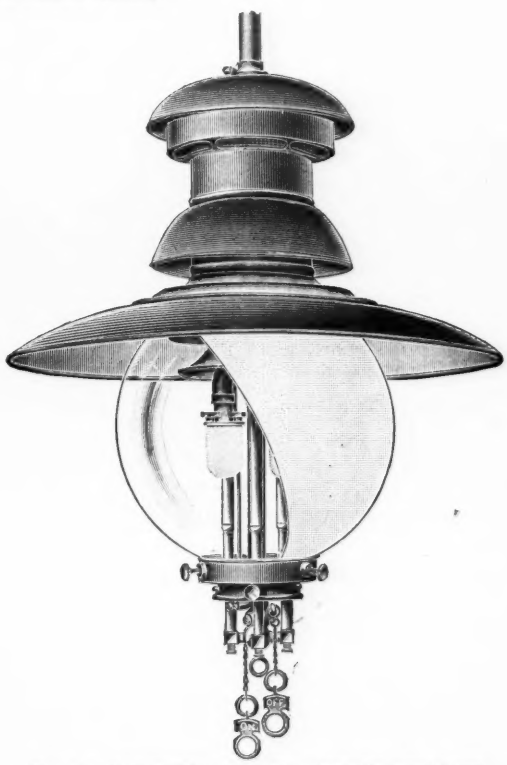
Fig. 3.—Bijou "Nico-Intense," in Polished Brass.

Fig. 4.—"Nico" Desk Light.

The Company have just opened a new and extensive show-room, which gives excellent facilities for making a selection to those able to visit it; but those who are not, will find in the catalogue already referred to full information regarding what is to be seen there.

SOME HIGH-POWER OUTDOOR & OTHER LAMPS.

AN inspection of the show-rooms of Messrs. A. E. Podmore and Co., at No. 33, Charles Street, Hatton Garden, E.C., reveals the fact that the firm have been devoting a considerable amount of attention to preparing themselves for coping with the anticipated demands of the coming lighting season; and, among other things, customers will be able to avail themselves of several new forms of high-power lamps for inverted burners. The designs referred to are primarily intended to meet the requirements of what, with regard to shops, is a most important branch of illumination—that is, the outside lighting.



The "A. E. P. Hatton Arc" Four-Light Inverted Lamp.

The first illustration shows the "A. E. P. Hatton Arc" Lamp, which is strong and durable, and is of British make. It can be fitted with two, three, or four high-power inverted burners; and it has an enamelled steel case and reflector. It is arranged to take mantles 54 mm. long, with standard sized ring. Another

lamp on the same principle, arranged for three or four inverted burners 54 mm. long, is the "Whittington," which is made in copper. Each burner can be separately adjusted. Another type of which the firm have lately made a feature is their recuperative inverted advertising lamp, which is suitable for use outside shops. The upper portion is made of copper; and the burners are of cast metal. There is an opal hexagonal reflector; and when the lamp is not required for advertising purposes, the glass curtain can, of course, be removed. Being shadowless, it is well adapted for railway stations and other like places. In this lamp, it may be remarked, the air-chamber is kept quite separate from the products of combustion. In the experimental as well as in the putting together shop are to be seen some things to which it would at present be premature to draw attention; but there is one lamp there which can, and deserves to, be noticed. This is a 2000-candle power hexagonal lamp with six burners, having an adjusting screw to each. The lamp is being made to fill an order for the Colonies, and so is arranged to be taken to pieces for shipment. All six burners can be used at one time, or only four or two; and each is fitted with a bye-pass. For cleaning purposes or the renewal of the mantles, the chimney can be pushed up into a receptacle provided for it in the top of the lamp; and it is so shaped that it is then caught in a spring and held in position. The six burners turn on a ground plug, so that the whole of them can be cleaned from one standpoint, without the attendant shifting his position. There are eight enamelled steel segmental reflectors for reflecting down the light; and the chimney gallery forms a protector for the bottom of the mantle, thus preventing any fraying out or the penetrating of undue draughts to the burner. This protector is fitted with gauze underneath; the holes being arranged at such an angle as to direct the air to the outside of the mantle. It, of course, also protects the burner from the entrance of insects, &c., which makes it specially suitable for the Colonies and other places where such a trouble is likely to be experienced. In short, it may be said that the burner is the patent dust and insect proof burner which has already been well tried, and met with a large measure of public favour for retort-houses, mills, foundries, machine shops, factories, schools, &c., where dust and draughts are prevalent.

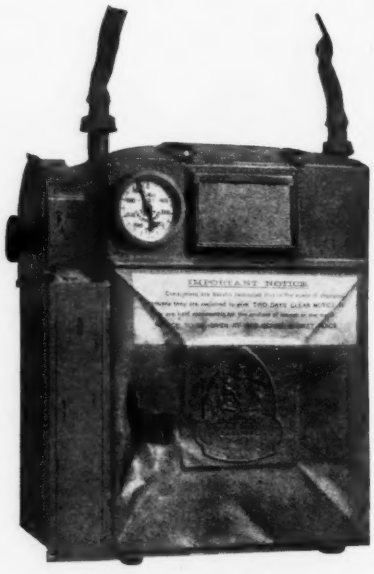
"A. E. P. Patent Modified Inverted Arc" Lamp.

As regards the inverted burners for inside lighting, attention may be drawn to the "A. E. P. Patent Modified Arc" Lamp for indoor purposes, by which it is claimed that a high efficiency is obtained. It is supplied (unless otherwise specially ordered) with three lights; the burners being of cast metal, and each fitted with separate taps to each burner and gas and air adjusting regulator. Removal of a screw enables a needle to be inserted for the purpose of clearing out the gas passage; and the burner can also be unscrewed when it is desired to clean it. Large or small sized mantles can be used; and one pilot light serves for the three burners. There are also to be seen different types of lights for billiard tables. The burner of one of these (which fits on to an ordinary arm) is provided with a length of flexible tubing, in such a manner that it forms an anti-vibrator; another is a suspension lamp for the centre of the table. Both are arranged for use with inverted burners.

PREPAYMENT METER CASH-BOXES.

THE accompanying illustration is reproduced from a photograph of a meter which successfully resisted the determined efforts of one of those thieves who make a speciality of prepayment meters left by outgoing tenants in unoccupied houses. We are indebted for it to Mr. Thomas Glover, of Norwich, whose attention was drawn to the question of thefts of coin from meters by remarks made by the Magistrates, the Recorder, and the Judge at the Assize Court, when trying cases of theft from prepayment meters—the authorities suggesting that it was the duty of the Gas Company to increase the strength of the cash-boxes used on the meters, and by so doing to lessen the temptation to both amateur and more or less professional thieves. Various designs of cash-boxes were examined; and the only one answering the Company's requirements as to security was found unsuitable in other respects. Under these circumstances, Mr. Glover designed the one shown in the photograph.

The exposed side of the casing is lined with "C.R.C.A." steel; while the front of the casing is provided with a cast frame with locking studs which engage with corresponding slots in the deep returned sides of the cast front of the drawer, which fits flush with the edges of the frame. A strong lock, requiring a special key, is firmly attached to the cast front of the drawer. At the time the meter was damaged, a number of empty premises were visited by the thief, and trifling amounts were taken from meters fitted with ordinary cash-boxes. The outgoing tenant of the shop where the meter with the new cash-box was fixed had given the required notice; and the meter had been cleared. The thief appears first



to have tried to pick the lock. Failing to do this, he wrenched the meter from the inlet and outlet connections, laid it on the floor, and applied a hammer and chisel. Deep dents are noticeable on the front and side. A determined effort appears to have been made to prise open the cash-box; but the closely-fitting front and frame locked together with studs prevented this being done. Having failed to get at the cash-box, the thief next cut an irregular hole into the front casing of the meter; but he found that there was no connection with the cash-box, and gave up the attempt.

NEW WINTER GOODS FROM THE ACME WORKS.

ONCE again Messrs. Arden Hill and Co. have proved their determination to be second to none in the matter of gas-fire development. Among their season's novelties are two entirely new fires—the "Saracen" and a new, and larger, fire of their "Radium" series, with 14-inch fire—both of which have the new patent "Thermo" fire-front. The "Thermo" embodies the latest principles in gas-fire construction. The metal fuel-guard by this method is entirely dispensed with; and therefore radiation is greatly increased. In addition, the new fuel composition which the firm are this season supplying with all their fires lends itself in a remarkable degree to perfect combustion. For utility and quiet dignity of design, the "Saracen" is well abreast of the best designs. It is made in two sizes, both having the "Thermo" fire-front; while the 14-inch "Saracen" is fitted with the new duplex burner, with "Simplex" gas and air adjustment, so that not only is the maximum radiation assured, but also economy of gas and ideal combustion.

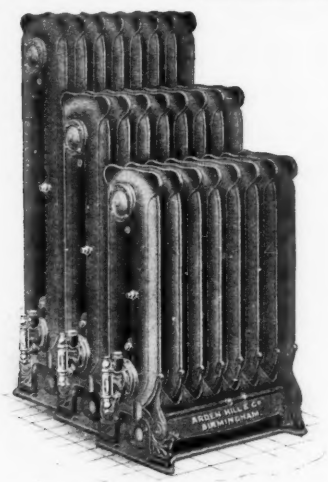
The "Saracen" Gas-Fire, with New Patent "Thermo" Fire-Front.

Most gas authorities are familiar with Messrs. Arden Hill's "Radium" gas-fire; and with many it commands a very wide

popularity. It is therefore safe to prophesy that the new 14-inch "Radium" will be as warmly welcomed as other members of its family. This latest addition has the "Thermo" fire-front; and the makers hope before long to be in a position to send out the smaller sizes also fitted in the same way. The new 14-inch "Radium" can also be fitted with the duplex burner, with the "Simplex" gas and air adjustment, if desired.

Fourteen-Inch "Radium" Gas-Fire, with Patent "Thermo" Fire-Front.

The firm's "Mars" gas-heated steam radiators have for several years been recognized as very effective and economical means of heating large buildings. This season two important improvements have been made in these radiators, adding largely, so we are informed, to their already high efficiency—viz., a water-inlet arrangement, and a perfected automatic air-valve. As compared with other methods of heating, the



The "Mars" Gas-Heated Steam Radiator.

"Mars" has the great advantages of being cheap to instal, suitable for any position, and merely requiring a gas connection.

Munich Chamber Furnaces.

A correspondent writes: "It will be remembered by readers that ten of the gigantic Munich furnaces erected in Hamburg were brought into action about May last. The cost of these ovens being regarded as extravagant, it was claimed by the inventor that the solid chambers would last a very long time, and that the consequent great economy in wear and tear would compensate for the heavy capital outlay. These expectations, however, appear to have proved fallacious. The chambers are said to be so badly cracked, and so absolutely leaky, that they cannot be worked any longer, and will have to be pulled down and entirely replaced by new ones. It would seem, therefore, that the structural difficulties in the Munich system have by no means been as yet overcome. This is interesting in view of the fact that the promoters of vertical retorts, in the course of the discussion at the last meeting of the German Association, declared that their experiments with large vertical chambers had not given satisfaction; and that both from the structural and the carbonizing points of view, they had so far every reason to adhere to carbonization in retorts."

Use of Coke Breeze Concrete.—The following editorial remarks appeared recently in the Engineering Supplement to "The Times:" "The responsibility of using coal residues in concrete is one that cannot be lightly undertaken by an engineer who is trusting lives and property to the strength of the concrete, either plain or reinforced. From advices which we have received, it would appear that steel embedded in concrete containing coke breeze and similar impurities is subject to deterioration, which may, under certain circumstances, be sufficient to condemn the beam or other member upon the strength of which the safety of the structure depends. The use of aggregates composed of coke breeze had been forbidden by law in Germany. From the interest which has been aroused on this subject, we trust that some steps will be taken to provide adequate safeguards against the use of concrete which may quickly crumble away, or in which the reinforcing bars are liable to deterioration."

THERMODYNAMICS AND THE HEAT-ENGINE.

By Dugald Clerk, F.R.S.

[Extracts from an Address to the Engineering Section of the British Association.]

At the middle of the last century, the steam-engine had attained to a high degree of perfection. Its development was, it is true incomplete; but it had been successfully applied to all the great duties of the mine, the water-works, the factory, the railway, and the steamship. Steam power was revolutionizing the whole of the social and industrial conditions of the globe. Notwithstanding this great material and engineering success, the world was in complete darkness as to the connection between steam motive power and heat. It was seen that motive power of almost any magnitude could be obtained by the agency of heat; but how it was obtained, and how much power was connected with a given quantity of heat, were quite unknown. The science of thermodynamics did not yet exist.

New light was dawning, however, which gradually illumined the whole world of pure science and engineering practice. Men of the very first rank in intellect—Newton, Cavendish, Rumford, Young, and Davy—had long before expressed the opinion that heat was not material in its nature, but was a mode of motion. But their opinions, though to some extent supported by experiment, made little impression upon the scientific world; and in 1850 we still find the most distinguished physicists adhering to the "caloric" or material theory of heat.

The great change from the errors of the old theories to the truth of the new was due to the work of Joule, Thomson, and Rankine in Great Britain, and of Carnot, Meyer, Clausius, Helmholtz, and Hirn on the Continent. The story begins with the work of Carnot in 1824, who published in Paris in that year a pamphlet entitled "Reflections upon the Motive Power of Heat." He was attracted by the problem of the steam-engine and the air-engine. He saw that heat and motive power were connected in some manner; and he endeavoured to settle in a quantitative way the limits of the connection by the invention of an ideal series of operations by means of which the greatest conceivable amount of mechanical power may be obtained from a given quantity of heat under certain circumstances.

For the purpose of his demonstration, he assumed only two things: (1) That if the heat be added to any body under standard conditions of temperature, pressure, and volume, and the body be carried through any series of mechanical processes, returning ultimately to the standard condition of temperature, pressure, and volume, then the quantity of heat added to the body is the same as that which has been discharged from it. (2) No process can exist whereby a given mechanical energy can increase its own quantity. On these indisputable assumptions he based his ideal cycle, which consists of four simple and easily imagined operations, occurring within a cylinder behind a piston so arranged that, during the cycle, work can be done by the working fluid upon the piston or work done by the piston on the working fluid. These are—

First Operation.—The given volume of the working fluid is to be imagined as confined at its highest temperature and pressure behind the piston; and heat is to be added to keep the temperature constant, while the fluid expands, moving the piston and doing work upon it.

Second Operation.—The supply of heat is cut off, and the working fluid expands, also during work on the piston, while its temperature falls to the lowest point, and its volume increases to its maximum.

Third Operation.—The piston returns, compressing the working fluid, but allowing the heat of compression to escape, so that the temperature remains during the operation at its lowest point.

Fourth Operation.—The piston compresses the working fluid, without allowing any loss of heat, to such an extent that the temperature rises again to its highest point, and the working fluid exists at the end of this operation at the same volume, pressure, and temperature as at the beginning.

Carnot succeeded in proposing a standard of efficiency which was applicable to any heat-engine, whatever the working fluid, and whatever the operative cycle. By his method a limit could be set, fixing the maximum of mechanical energy to be obtained from a given heat quantity and a given temperature range. To reduce this to numerical values, it was necessary, however, to experiment on any one working fluid within the desired temperature range in order to determine the work area in its relation to heat quantity and temperature fall. Carnot's writings show that he intended to make such observations; and, had he succeeded, thermodynamics would have become a science at an early date. His death, however, in 1832, at the sadly early age of 36, prevented this development. The name of Sadi Carnot will always be remembered by mankind as being the founder of one branch of the thermodynamics of the heat-engine.

His work remained practically without notice for thirteen years after his death, when, fortunately, it attracted the attention of William Thomson during his attendance at the laboratory of Regnault in the year 1845. He took up the study of Carnot's work with enthusiasm. He became Professor of Natural Philosophy in the University of Glasgow in 1846, and in 1848 he read a paper before the Cambridge Philosophical Society "On an

Absolute Thermometric Scale Founded on Carnot's Theory of the Motive Power of Heat and Calculated from Regnault's Observations." To his acute and brilliant intellect it became apparent that he had in the Carnot cycle a powerful instrument capable of widely general use, apart altogether from the theory of heat-engines; and he used it in a most skilful way to give definiteness and universal application to the idea of temperature, as Professor Larmor states, "elevating the idea of temperature from a mere featureless record or comparison of thermometers into a general principle of physical nature." Thomson accordingly defined equal differences of temperature in terms of the reversible or Carnot engine.

Thomson followed up his early work on the absolute thermometric scale with an investigation entitled "Carnot's Theory of the Motive Power of Heat," described in a paper read in 1849 before the Royal Society of Edinburgh, in which he calculated from Regnault's experiments on steam the power developed by a Carnot reversible engine when using 1° C. heat unit—that is, the heat necessary to heat 1 lb. of water through 1° C. for temperatures from 1° to 231° C., the temperature falling in the engine in each case to 0° C. In this paper he asked himself two questions: (1) What is the precise nature of the thermal agency by means of which mechanical effect is to be produced without effects of any other kind? (2) How may the amount of thermal agency necessary for performing a given quantity of work be estimated?

Using Regnault's values for the properties of steam, he calculated the lines of compression and expansion without heat loss, the lines of compression and expansion with heat flow at the lowest temperature, and heat addition at the highest temperature, and thus arrived at the work area per heat unit let down. He tabulated these results, and showed that what he calls Carnot's function diminishes as temperature rises, using the ordinary centigrade scale. On the calorific theory, the methods are rigidly logical and correct; but some inaccuracy is introduced by the necessity of that theory for the discharge of the same amount of heat at the third operation as is taken in on the first. The paper is of great interest, however, because it shows clearly how fully the distinguished author realized the necessity for re-examining the standard ideas of the nature of heat.

Assume, then, the truth of the caloric theory of heat, as Thomson does in the paper, we have a complete theory of the heat-engine, based on the Carnot cycle, accounting for efficiencies which vary with temperature differences, but requiring no definite mechanical equivalent of heat; nay, antagonistic to the existence of such an equivalent. The caloric theory is quite consistent with the theoretical possibility of obtaining an indefinitely great amount of mechanical energy from a given quantity of heat, provided the letting-down or fall of level be indefinitely great.

At the time we are discussing (1850), the bare conception of the idea of an absolute zero of temperature was one which was startling in its boldness; and it must have been difficult indeed then to imagine any definite line of proof which could be followed to establish the real existence of such a physical limit. No such limit could be proved, even by the aid of the Carnot cycle, reasoning on the material theory of heat. Thomson's promises of further investigation were fulfilled in 1850, in which year he definitely accepted the dynamical theory of heat, and finally abandoned the material theory. His conclusions are given in a memoir of the first importance which was read before the Royal Society of Edinburgh in 1851. It was entitled "On the Dynamical Theory of Heat." Before dealing with it, however, it is desirable to consider the work of Joule and others on another side of thermodynamics.

Long before 1850, the equivalence of mechanical work and heat quantity had been accepted by many scientific men; and Rumford had, indeed, made measurements of a rough kind. It remained, however, for Joule experimentally to determine the mechanical equivalent in the most accurate manner, and place what is now known as the first law of thermodynamics upon the sure basis of absolute experimental determination. His first paper was read before the Cork meeting of the British Association in 1843, and at the Oxford meeting in 1847 he read another, "On the Mechanical Equivalent of Heat," describing the results of experiments with paddles rotating in liquids driven by falling weights. By these years of work he had absolutely demonstrated the equivalence of heat quantity and mechanical work, so that no loophole of escape seemed possible. It appeared as if the material theory was rendered intellectually impossible to the trained intellect. This was not the fact, however, as is evident from both Joule's and Thomson's accounts of that British Association meeting.

Joule's earlier paper had been coolly received. Indeed, it is evident that the idea of a mechanical equivalent of heat was still distasteful to the physicists of the day, and its discussion was looked upon with dislike. At the 1847 meeting, Joule addressed a small audience; and the account of his experiments was received without enthusiasm. This adverse atmosphere, so discouraging to the investigator, was quickly removed, however, when a young man rose to make some remarks, and, by his enthusiastic comment and clear reasoning, at once succeeded in attracting the interest of those present. This young man was William Thomson. But although he was much struck by Joule's experiments, Thomson did not accept the dynamical theory of heat at once. As he stated himself: "I had first thought it could not be true because it was different from Carnot's theory."

Joule's discoveries at this date may be thus expressed: Heat and mechanical energy are mutually convertible, and heat requires for its production, and produces by its disappearance, mechanical energy in the proportion of 1390 foot-pounds for each centigrade heat unit—a heat unit being the amount of heat necessary to heat 1 lb. of water through 1° C. Knowing, as Thomson did, that mechanical energy could be produced by the agency of heat, but that its amount varied with the temperature and temperature fall, Joule's discoveries seemed antagonistic to Carnot's demonstration; and, convinced as he was that Carnot's law was true, he naturally felt at first that there must be some other way of looking at Joule's results than that adopted by Joule himself. Joule had proved the generation of heat by means of mechanical work; Thomson required the proof of the converse case—the disappearance of heat when mechanical work was done by the working fluid. This was forthcoming in the results of experiments on the compression and expansion of air. Air was the working fluid actually investigated; and the determination of its properties at ordinary temperatures was a vitally important result of the co-operation of Thomson and Joule. Their experiments lasted for many years; and their rigorous investigation disclosed the fact that internal work was done in expanding a gas—in fact, that in a gas expanding isothermally doing work, part of the heat only disappeared in external work, part was absorbed in separating the molecules.

The Joule and Carnot laws are now known as the first and second laws of thermodynamics. The second law, in modern form, may be thus stated: Although heat and work are mutually convertible and in definite and invariable proportions, yet no conceivable heat-engine is able to convert all the heat given to it into work. Apart altogether from practical limitations, a certain portion of the heat must be passed from the hot body to the cold body in order that the remainder may assume the form of mechanical energy. The proportion of the total heat convertible into mechanical energy depends on the absolute temperatures of the hot and cold bodies. It is unity *minus* the lower absolute temperature upon the upper absolute temperature.

It appears that during Thomson's struggle to reconcile the two apparently opposing laws, Clausius, who had seen the same difficulty, arrived independently at its solution, and published a paper, "On the Motive Power of Heat and the Laws of Heat which may be Deduced Therefrom," at the Berlin Academy, in February, 1850. In this paper he discussed Thomson's difficulties, and also arrived at the conclusion that the Carnot cycle might be reconciled to Joule's law by the omission of the supposition that during the third process the same amount of heat is discharged from the cool body as was taken in from the hot one. In his 1851 paper, Thomson gave Clausius full credit for solving the difficulty between the Carnot and the Joule principles, and also for priority; but he stated that he himself was working on the same problem, and had arrived at the same solution in the year 1850, before he had seen Clausius' work. Clausius, however, assumed the theory of a permanent gas, which required the absence of internal work; but Thomson was not prepared to assume this without experiment. This determination rigidly to prove every necessary assumption, and his clear conception of the points necessary for proof, led to the extensive series of researches undertaken by Thomson and Joule with the object of determining how much gas thermometers differ from an absolute scale as determined by the combination of the Joule and Carnot laws.

Rankine, as early as 1849, arrived at the general equation of thermodynamics which expresses the relation between heat and mechanical energy, and indicated the result of his investigations to the Royal Society of Edinburgh in February, 1850. He thus arrived independently at the same result as Clausius about the same time. Both Rankine and Clausius, however, adopted certain theories as to the molecular structures and motions of gases, and their demonstrations to some extent depended upon their theories. To Thomson and Joule we are deeply indebted for the proof of the two laws, and for the rigid deduction of the modern scale of temperature and the determination of absolute zero in its modern form.

Clausius appears to have anticipated Thomson, not in the suggestion of an absolute scale of temperature, but in the idea of an absolute zero founded upon the combination of Carnot's and Joule's laws. Thomson, in his papers, very modestly attributes the second law—the law of the transformation of heat—to Carnot and Clausius. But in this he undervalued his work, because Clausius appears to have assumed what Thomson and Joule proved—viz., the coincidence of the absolute scale with the air thermometer scale.

It will thus be seen that the position usually assumed by the engineer in 1850, of the equality between heat given to the engine and heat given to the condenser, was fundamentally untrue. Without this deduction, however, no determination of values of the Carnot function could have led to the determination of an absolute zero. According to the material theory, as seen in the light of Carnot's cycle, a heat unit could give an indefinitely increased amount of work with lowering of temperature. Nothing in the theory sets a limit to this increase; and, accordingly, there is nothing to suggest an absolute zero. Immediately, however, we accept the dynamical theory of heat, we find that 1 lb. of water requires the exertion of 1390 foot-pounds of work to heat it through 1° C. We also know from the Carnot cycle that, under ordinary conditions of human existence, only a portion of this work can be returned. But as no conditions could conceivably

exist in which a greater amount of work could be obtained from a pound of water than the 1390 foot-pounds put into it to heat it through 1° C., it follows that, inasmuch as the Carnot function increases with diminishing temperature, the limit of temperature is reached when, according to the Carnot cycle, the whole of the work, put into the pound of water, can be got out again as work. This limit is the absolute zero of temperature. No lower temperature is conceivable without introducing the idea of the creation of energy. So far as human beings are concerned, this idea is as inconceivable as the idea of the creation of matter. The determination of this limit with the close accuracy necessary for a well-founded constant, is to be entirely attributed to Thomson and Joule. In his 1851 paper, Thomson thus succeeds in answering the questions which he put to himself in his 1849 paper, and he supplies a quantitative method of connecting the amount of the thermal agency necessary with the amount of work which can be performed under varying conditions. All engineers dealing with motive power are thus deeply in debt to Thomson and Joule for the secure position occupied by them to-day.

The ideas of Thomson and Joule now form so much of the basis of all reasoning upon motive-power engines, that there is some little danger to the present generation of forgetting what they owe to these two great men. To appreciate the step made by them, it is necessary to consider the position of motive power produced by heat at about the middle of the last century. At that time many attempts had been made to displace the steam-engine as a heat-engine by air-engines in various forms—both engines heated externally and those heated internally, now known as internal-combustion engines. Papers read at the Institution of Civil Engineers in 1845 and 1853, and the discussion of those papers by eminent men of the day, supply an accurate measure of the knowledge possessed by the engineer of the principles of action of his heat-engines. In the latter year, four papers were read: "On the Use of Heated Air as a Motive Power," by Benjamin Cheverton; "On the Caloric Engine," by Charles Manby; "On the Principle of the Caloric Air-Heated Engine," by James Leslie; and "On the Conversion of Heat into Mechanical Effect," by Charles William Siemens.

Mr. Clerk dealt in detail with the first three papers, and then proceeded: We now come to Mr. Siemens's paper; and for the first time we find the engineer guided by an intelligible principle. Siemens discussed the material theory of heat, and accepted unreservedly the dynamical theory, for which he gives a large measure of credit to Joule. This is the first of the Institution papers in which I find the name of Joule. Siemens names Carnot, Clapeyron, Holtzman (of Mannheim), Joule, Helmholtz, Meyer, Rankine, and Professor Thomson. Curiously enough, though he mentions Carnot and the other philosophers who dealt with the Carnot principle, including Thomson, he does not appear at this date (May 17, 1853) to have realized himself the effect of the law of Carnot upon the theory of the heat-engine. He clearly appreciated the first law, and gives the mechanical equivalent of heat as determined by Joule at 770 foot-pounds, and by Thomson's formula as 772 foot-pounds; but in discussing the principles of the heat-engine he is of opinion that a perfect engine is ideally possible giving 770 foot-pounds for each Fahrenheit heat unit employed. This is clear from a table given in the paper. He apprehends the mechanical equivalent of heat, but still appears to be under the impression that if heat be added to a certain upper temperature, and expansion take place until the original temperature is reached, he has a perfect engine indicating the full result of Joule's mechanical equivalent. He sees, however, that the old theory of the regenerator is quite wrong. In the discussion upon the paper, he rightly upheld the regenerator as useful, and saw that there were limitations to its use. Mr. Hawksley contended that the regenerator was useless; while Mr. Pole considered that it was useful, but he did not definitely adopt the mechanical theory of heat. Armstrong concurred with Siemens and Pole. He believed in the utility of the regenerator, limited as described by both. Mr. Edward Woods certainly understood Siemens to have given 772 foot-pounds as the efficiency of an ideal heat-engine, because he stated that this showed there was still great room for improvement in engines.

This discussion puts us in the position of engineers at the date of the last meeting referred to—viz., May 17, 1853. Of all the distinguished engineers who spoke, Siemens alone had thoroughly apprehended the value of Joule's results, and understood the full bearing of the mechanical equivalent of heat. He had not, however, understood Carnot's reasoning on the Carnot cycle, or Thomson's deductions from Carnot. He was under the impression that heat added in any way to a working fluid, raising the temperature, could be entirely converted into work by sufficient expansion. He had not appreciated that, even if expansion be carried far enough to reduce the temperature to the original temperature before the addition of heat, yet complete conversion of the entire mechanical equivalent was impossible. When so able a man as Siemens had at this stage only reached partial enlightenment, it was evident that much hard work and clear thinking required to be done before a well-founded theory of heat motive power could be obtained.

The data for such a theory were accumulating; and one of the most interesting circumstances connected with these Institution of Civil Engineers papers was a communication from M. Regnault to Colonel Sabine, the Treasurer of the Royal Society, dated April, 1853, in which he stated that he was about to publish immediately a series of elaborate experimental researches on various subjects connected with the effects of heat on elastic fluids, the results of which would solve many questions long in dispute, and by means of which engineers might accurately calculate the effect of a given amount of fuel, in whatever way it was applied. He communicated, in anticipation, that he had arrived at the number 0·237 for the specific heat of air at constant pressure, and at 0·475 for that of steam under atmospheric elasticity—the specific heat of water being taken in each case as unity.

True to his word, Regnault produced his admirable investigations, and succeeded in solving many problems; but he did not settle the questions to the extent he had hoped. Even at the present time doubt arises as to the very values he gave for the specific heat of air and steam. The problem proved much more difficult than he had anticipated; and for modern engine purposes it cannot be considered as being wholly solved now—fifty-five years later.

This description of the position of the hot-air engine, as shown by the opinions of eminent engineers, is most useful as proving how much practical men were in need of the work of Thomson and Joule. It is not surprising that, of all the engineers present, Siemens appeared to be alone in thoroughly grasping the new ideas. Thomson's own conversion from the material theory of heat to the dynamical theory was not complete until 1851; and though he had then succeeded in reconciling the ideas of Joule and Carnot, it is not to be wondered at that engineers two years later had not quite succeeded in grasping the combination of the two laws. This combination, however, supplied engineers with a new and accurate standard of measurement for studying and improving upon their heat-engines, and they were by no means slow in grasping the help thus offered them by the abstract scientific man. The broad laws of thermodynamics have placed the theory of the heat-engine in a position of certainty, which was much needed.

It would be a mistake to assume, however, that even the determination of the mechanical equivalent of heat and the second law of thermodynamics expressed in terms of an absolute thermometric scale had solved all the difficulties of the engineer desiring to determine the efficiency of his heat-engines. Thomson, Joule, Rankine, and their great Continental colleagues, it is true, settled once and for all the broad laws of thermodynamics; but the Carnot cycle is one which is, as has been repeatedly shown, an impossible one in practice. Accordingly, actual engines have to operate upon imperfect cycles. The theory of these has been worked out mostly during the last twenty-five years, though Rankine made a beginning in dealing with the theory of the Joule air-engine. For the first time he showed the existence of what may be termed a cycle of constant efficiency in the case of that engine. He indicated in his formula that the thermal efficiency is independent of the maximum temperature as long as this exceeds the temperature of adiabatic compression. He made no statement, however, that this engine is within a certain range independent of the maximum temperature—that is, that increasing maximum temperature does not increase efficiency. Subsequent work has shown that, on a simple assumption, such as constant specific heat, many engine cycles exist of a practicable nature having high theoretical efficiencies where the theoretical efficiency depends on one thing only—ratio of compression.

Some misunderstanding has arisen with regard to these imperfect cycles; and it has even been thought that they would be contrary to the second law of thermodynamics. Lord Kelvin himself was of this opinion in 1881. It is true that these values, as has been shown, must always determine the extreme limit of possible efficiencies between certain temperatures; and in cycles of constant efficiency the particular efficiency of the cycle is always less than that of a Carnot cycle engine working between the same limits of superior and inferior temperature. Investigation, however, of these imperfect cycles is much more difficult than the broad investigation of general thermodynamic laws, because it requires accurate knowledge of the properties of the working fluid dealt with under conditions rendering observation extremely difficult.

The modern internal combustion motor is the successor to the air-engine so fully discussed by eminent engineers of fifty-five years ago; and the forebodings of so eminent a man as Faraday as to its ultimate success have proved unfounded. Great difficulties have been encountered, and many discrepancies have had to be explained; but a minute study of the nature of the working fluid has rendered it more and more possible to calculate the efficiencies to be expected under practical conditions. At the present time, we can deal with almost any cycle or any working fluid with some fair approximation to an accurate result. Much work, however, is required before all problems of the working fluid can be said to be solved with regard to any heat-engine. Indeed, it may be said that, under modern conditions of the use of steam, even the properties of the working fluid—steam—have not yet been satisfactorily determined. The mere question of the specific heat, for example, of steam, and its variations of temperature and pressure, is now under review; and important experiments are in progress in Britain and on the Continent to determine these properties. The properties of the working fluid of the internal combustion motor are also the subject of earnest study by many Continental and British investigators. Notwithstanding all the perplexities involved in the minute study of the imperfect heat-engine cycles, we are in a very different position to-day from that of the engineer of 1853. We know all the broad laws as to the conversion of heat into work or of work into heat;

and, numerous as are the problems yet to be solved, we at least profit by the guiding light set out for us by Kelvin, by Joule, and by Rankine.

POSITION OF THE CHEMICAL INDUSTRIES.

The various sectional meetings of the British Association were opened last Thursday. In the Chemistry Section, Professor F. S. Kipping, D.Sc., F.R.S., the President, delivered an address, in which he considered whether any steps could be taken to place the chemical industries of the United Kingdom in a more prominent position than they now occupy in the world of commerce.

He said there were few branches of industry to which chemistry, in one way or another, was not of supreme importance. On all hands there were problems awaiting solution; and the nation which solved them would not only progress in civilization and contentment, but would also justly claim to have taken a leading part in the advancement of science. Those who doubted the seriousness of our condition might find statistical evidence, more than sufficient to convince them, in the technical journals and in the Board of Trade reports of recent years. The facts there disclosed showed that in the manufacture of "fine chemicals," including perfumes, alkaloids, and crude coal-tar products, as well as dyes, the decadence of our industry was far advanced. In the case of heavy chemicals the position was, perhaps, not quite so serious at the present moment; but the future was dark and threatening. Chemical industries were so intimately connected and dependent on one another that the fate of one might determine the fate of all. The bye-product of one process was often the raw material of another. Who, then, could deny that the patience, perseverance, and high scientific skill which had built up the colour industry abroad, if applied, as they had been and were being applied, to the manufacture of heavy chemicals, would not soon defy all competition from less progressive countries? Such a possibility was full of national danger. It had been pointed out that from present indications a time would arrive when we should be dependent on outside sources, not only for our food supply, but also for our means of self-defence. When nitrates were exhausted, when nitric acid and ammonia were prepared from the components of the atmosphere, when all chemical industries had been so highly developed abroad that they have completely vanished from these islands, and when their loss had reacted on all our other important industries, then, indeed, should we feel the pinch of poverty; then, indeed, must we submit to national decay.

The new Patent Act, which came into force this year, seemed to many to have inaugurated a new era, and removed one of the principal causes of the decline of chemical industries. If this were so, it was all the more important that the representatives of chemical science should be ready and willing to join hands with the manufacturers in order to assist in the process of regeneration. Some of the results of this amendment, and some indications of the great industrial changes which it would bring about, were already obvious. Foreign firms or individuals who held British patents, and who had not sufficient capital to work them in this country, or did not think they were worth working here, were attempting to sell their British patent rights. Others were building or buying works in Great Britain; and it had been estimated that in the immediate future a sum of at least £25,000,000 of foreign capital would have been thus invested in order to comply with the new law. The conclusion which seemed forced upon us, however, was that, though the new Patent Act would prove to be of great value in many respects, it would do little to foster British chemical trade and the development of British chemistry. It placed us on an equality with other countries as regards patent rights, and remedied an outstanding grievance; but unless we had something to patent this equality would be valueless, and our chemical industries would continue to decline, possibly more rapidly than heretofore.

Some of the causes which had been suggested as contributory to our failure were: (1) The unsatisfactory condition of secondary education; (2) the nature of the training which is given to chemists in our Universities and other institutions; (3) the insufficiency of the time and money devoted to research in the manufacturing industries; and (4) the lack of co-operation between manufacturers and men of science. Whether far-reaching results would follow if our system of secondary education were very much improved, it was impossible to predicate; but there was no doubt that at the present time we were moving in an exactly opposite direction. The shadow of the cypress rested upon our chemical trade, and manufacturers did not now see their way to employ chemists. Students were not attracted to chemistry as a profession because there were so few openings; and without an ample and increasing supply of such students, chemical industry must continue to decline. As a necessary consequence, the development of pure chemistry was cramped and hindered to a far greater extent than was generally realized. It was necessary, in the first place, to arrive at some conclusion as to the kind of training required for the future works chemist. On consulting the opinions of manufacturers, it would seem that they attached great importance to what was called the "practical side." They believed that, in addition to a knowledge of theoretical chemistry, the prospective works chemist should also have some acquaintance with engineering, should understand the apparatus and the machinery used in the particular manufacturing operations with which he was going to deal, and should have had practical experience in working the given process. It was from this point of view that we built and equipped large technological chemistry departments, such as those in the Universities of Birmingham and Leeds and in the Manchester Municipal School of Technology—departments fitted up with very complete apparatus and machinery for carrying out operations on a miniature manufacturing scale.

The arguments in favour of this view—that it was a hybrid chemist-engineer who was required in a chemical works—seemed to Professor Kipping to be fundamentally unsound, and the kind of training suggested by them for the works chemist could only result in the production of a sort of combined analytical machine and foreman. We could not possibly expect such a poorly-trained Jack-of-all-trades to run a chemical works successfully in the face of competition directed by a large staff of scientific experts in chemistry and engineering. It was useless to spend immense sums of money on expensive machinery of the newest type in order that the works chemist might be able to tell his future employer that the machinery used in the works was completely out of date. The conditions in a chemical works could not be successfully imitated in a University or Polytechnic. Any attempt to do so could only lead to mistaken conclusions, and thus have the effect of rendering the works chemist quite helpless when he passed from the elegant models of his educational apparatus to the work-a-day appliances of the manufactory.

It seemed to Professor Kipping that here we touched the bed-rock of our trouble. We had failed to realize that industrial chemistry must be based on a foundation of continuous and arduous research work. Just when a student has reached a stage at which his specialized scientific training should begin, his course was finished; and whether he had been to a University or to a Polytechnic mattered little. He joined the band of those who subsisted on, but who did nothing to advance, chemical industry. He entered a works. The manufacturer did not realize exactly what his chemist ought to do, but he expected some immediate results, and in consequence was generally disappointed. The lack of success of the chemist was put down to his ignorance of practical matters, and there was an outcry for technical education. Science was most unjustly discredited; and any suggestion of spending money on research work was scouted as a mere waste. If we were to meet successfully the very formidable scientific and commercial organization opposed to us in chemical industry, we must perforce adopt the methods of our competitors. Not only must we learn patience and perseverance, but we must also call to our aid the best brain power available. In order to acquire the necessary knowledge of facts and theory, and afterwards to devote even the minimum time to gaining experience in research methods, the future works chemist must be prepared to continue at the University or other institution for at least five years. By extending the period of training, and making research work compulsory as far as possible, a great deal would be gained. Pure science would reap an immediate benefit from the investigations of the students, as had been the case abroad, and this stimulus would necessarily react on industrial chemistry. The manufacturers could be assured that they were being supplied with men of the right type. They would soon come to recognize this fact, and the demand for works chemists would expand.

The worker in pure science, unaided by the advice of the manufacturer and business man, had little chance of solving any important technological problem, except as the result of accident. He had not the requisite acquaintance with commercial conditions. Even if all the research capacity of the country were henceforth devoted to purely technical matters, any great improvement in our industries could hardly be anticipated without the active co-operation of the manufacturers. When once this co-operation of the manufacturers has been secured, the demand for research chemists would expand, and the laboratories would be filled with students whose help in pure science would be invaluable. One of the greatest advantages of such a working arrangement would be that it would lead to the evolution of what was otherwise almost unattainable—viz., men thoroughly trained in both science and practice. The research students in a teaching institution, engaged on a given problem for a manufacturer, would of course be allowed to study its practical aspects in the works. On the other hand, works chemists with considerable practical experience would be granted permission to proceed to the University laboratory, where they would study the problem with the assistance of the highest scientific knowledge, and acquire further training in methods of research. Combinations such as these could hardly fail to lead to valuable results, which would form the subject of patents. The monopolies thus acquired would place the manufacturers in a favourable position, and the revival of our chemical industries would follow in due course.

On Saturday, the 29th ult., the Earl of Rosse died at Birr Castle, King's County, in his 68th year. Deceased was a distinguished man of science, and was President of the Royal Dublin Society from 1887 to 1892, and of the Royal Irish Academy from 1895 to 1900. His death calls for notice in our columns from the fact that he was Chairman of the House of Lords Committee who, in 1905, considered the Bill promoted by the London County Council to amend the Acts relating to the supply of gas in the Metropolis.

THE CONTROL OF RETORT-SETTINGS.

At the Fifty-Fifth Annual Meeting of the Association of Gas and Water Engineers of Saxony-Thuringia, at Eisenach, Dr. K. Bunte (son of Professor H. Bunte of Carlsruhe) delivered a lecture on this subject. It was reprinted in the last number of the "Journal für Gasbeleuchtung," from which the following abstract translation has been made.

It depends very much on the proper behaviour of the retort-settings whether the whole working of a gas-works will afford satisfaction or cause vexation. The proper control of the settings gives its immediate reward. For instance, if the fuel consumed can be reduced from 17 to 16 per cent. of the weight of coal carbonized, the economy achieved for one bed of eight retorts amounts to about 50s. a month. [Dr. Bunte, however, values his coke at 25s. per ton.] Nevertheless many managers continue to be content with very moderate results in the working of their retort-settings, perhaps because of the multiplicity of influences affecting the results obtained. The more the construction of a setting takes account of all these influences, the more complex does it become, and the more care must be given to its manipulation. It is proposed to set out briefly the points which are of importance for the appraisement and management of settings. Following the natural and logical evolution of retort-settings, the open-grate or direct-fired setting will be taken as the first type; then the regenerative setting; and, finally, the semi-producer or moveable-bar grate, which stands midway between the other two types. These will be dealt with in order.

The original mode of direct firing of retorts was by the simple grate. This grate has continued to be used up to the present day because of the low cost of its installation and upkeep, and of its simplicity in use. The most common variety nowadays is perhaps one in which there is a small admission of air above the grate. The heat liberated from the fuel in the typical direct-fired setting is directly transmitted to the retorts, mainly by radiation and the hot furnace gases. A certain temperature is requisite for the distillation of coal, which nowadays is taken as not less than 1000° C.; and the flue gases must therefore leave the retort chamber at that temperature. Hence they then contain a certain amount of heat which cannot forthwith be utilized. This heat is expressed by the number of units which the gas would give up in cooling from 1000° C. to the atmospheric temperature. It, approximately, amounts to 1000 times the mean specific heat of the mixture of gases which pass into the flue. Only a certain amount of heat is made available by the combustion of the fuel; and it can be calculated what temperature the quantity of flue gases which result will have. The difference between this and the 1000° will indicate what is the available heat or fall of temperature. A ratio is thus obtained between the quantity of heat utilizable—*i.e.*, that represented by the fall from the extreme or limiting temperature to the temperature at which the flue gases escape—and the quantity not utilizable, which is that represented by the fall from the temperature of the flue gases to the atmospheric temperature. Similarly, the ratio of the utilizable heat to the total heat developed from the fuel is obtainable, and this value is known as the net efficiency or duty of the heating. The extreme or limiting temperatures are theoretical; but they can be rightly applied in calculating the efficiency, provided the mean specific heat of the flue gases is correctly known for the temperature at which they escape. If the temperatures are not very high, the calculated limiting temperatures are not, in fact, very far removed from those actually realized.

The figures required for calculating the limiting temperature, and estimating the efficiency therefrom, are the amount of heat developed, and the capacity for heat of the furnace gases, which are determined through analysis. If, for example, these gases are found on analysis to contain 14 per cent. of carbonic acid, the number of calories liberated in the formation of the carbonic acid contained in any given volume of the furnace gases can be calculated. The number of calories so ascertained are available to heat the mixture of 14 per cent. of carbonic acid and 86 per cent. of oxygen and nitrogen to a certain limit temperature depending on the specific heats of the gases. Taking the specific heat of carbonic acid at 0·5035, and that of the mixture of oxygen and nitrogen at 0·3295, the limiting temperature becomes 1715° C., and the efficiency of the heating 42 per cent. That is to say, 42 per cent. of the heat is utilizable, while the remaining 58 per cent. goes into the chimney with the flue gases.

The following figures were obtained for a direct-fired setting:—

Time.	Carbonic Acid.	Limiting Temperature.	Net Duty.
h.m.	Per Cent.	Deg. C.	Per Cent.
2.57	15·9	2100	52·3
3.4	14·4	1930	48·2
3.11	13·0	1770	43·5
3.18	11·2	1510	33·8
3.25	11·0	1480	32·4
[Fire made up.]			
3.38	15·0	1990	49·7
3.46	15·6	2070	51·7
3.54	15·4	2020	50·0
4.2	14·5	1930	42·8
4.10	11·6	1560	35·9

It will be seen from these figures how the net duty falls almost to one-half its former value in the course of the burning away of the fuel and the reduction in the proportion of carbonic acid. The decrease in the carbonic acid arises from the diminution in the depth of the bed of fuel as it burns away; and it might therefore be supposed that the reduction in the depth could be retarded by using a larger grate. The grate, however, must not be too large in area, if a proper draught is to be secured. If the velocity of the current of air through the grate is slackened, the carbonic acid is reduced to carbonic oxide by contact with the hot coke. The direct-fired setting requires frequent firing and raking of the fuel-bed, and therefore demands careful attention on the part of the stoker, in order to secure proper working. Unfortunately, there is usually either excess of air or excess of carbonic oxide, because of the difficulty of maintaining intimate contact between a solid fuel and the air required for combustion, and of securing the interaction of the last traces of oxygen with the fuel.

Passing on to the second type of settings—*i.e.*, the producer or regenerative furnace—it will be seen that the combustion therein is divided into two stages, the primary combustion, which theoretically needs one-half of the total air supply, and the secondary combustion, which requires the other half. Only a comparatively small part of the heat produced is liberated by the primary combustion; over twice as much is set free in the secondary combustion. The advantage afforded by gas-firing is therefore that combustible gas is consumed with air, and consequently complete admixture of the fuel and air can be secured, with the result that combustion takes place as nearly as possible according to theory. Further, two thirds of the heat is developed in the place where it can be directly used—two-thirds of the whole combustion is transferred from the grate to the retort-chamber. The primary combustion affords 1 volume of carbonic acid and 2 volumes of nitrogen for every 2½ volumes of air employed; and the limiting temperature attainable is 1290° C. The producer gas thus formed needs for its combustion a quantity of air equal to that of the primary air supply; and if its secondary air supply is cold, the mixture of producer gas and secondary air will have a temperature of only 740° C. When work is being started in a cold setting, this mixture, reduced in temperature as it is by contact with the cold masonry, is too cold for ignition; and it escapes unignited from the furnace, and may ignite with explosive violence later on. Hence, when a setting is being put into action, the lid of the producer must be left open, and the producer gas allowed to burn immediately above the fuel until the exit passage or nozzles have been brought to a red heat.

The secondary combustion develops sufficient heat to give a limiting temperature of 2380° C. and a net duty of 58 per cent. This is no higher than the theoretical duty of direct-firing; but there is now the possibility of securing some better application of the air required for combustion. By previous warming of the secondary air supply, it is possible to withdraw heat from the chimney gases escaping at 1000° C. and to restore it to the setting; and thereby the limiting temperature is raised to 2820° C., and the net duty to 64·6 per cent. It is further possible to increase the quantity of secondary air without having an excess of air. This is accomplished by replacing a portion of the primary air by water vapour. The water vapour forms, with the carbon of the fuel, carbonic oxide and hydrogen. One volume of water vapour replaces half a volume of oxygen, or 2½ volumes of air, which quantity of air must be added in the previously heated secondary air supply. The total air used remains the same in quantity, as the water vapour introduced is recovered on combustion. The decomposition of the water vapour absorbs heat; and as this reaction proceeds simultaneously with the formation of carbonic acid in the lower portion of the bed of fuel, the temperature is correspondingly reduced. It then becomes possible to heat the primary air before admission, without running the risk of fusing the ash and the grate-bars by the heat produced on combustion. The process of the decomposition of water vapour with the formation of water gas, which absorbs heat, can proceed to a certain extent alongside the process for the formation of producer gas, which affords heat. The theoretical and practical limit at which the heat effects really come into equilibrium is represented by a consumption of 0·7 lb. of water vapour to 1 lb. of carbon. In practice, however, there are losses of heat which reduce the amount of water generally evaporated to half the weight of the carbon consumed. The evaporation of water not only favours the recovery of heat by regeneration, but avoids the formation of clinker and admits of the development of heat being transferred in an increased degree from the grate to the chamber of the setting. The producer must have a grate of large area, as the flow through it must be slow, in order to give time for the conversion of the carbonic acid and the water vapour into carbonic oxide by the hot coke to occur. The dependence of these two processes on temperature is shown in the diagrams (p. 654), of which fig. 1 gives the equilibrium attained at different temperatures in the producer gas process, and fig. 2 the equilibrium for the water-gas process. The curves indicate the ideal percentage composition of producer gas and water gas corresponding to different temperatures of formation. These compositions can only be obtained if the gases and the carbon have time, on contact, to reach a condition of equilibrium. Practically, a more or less good approximation to these figures is secured according to the time allowed for the reaction. In both cases a raising of the temperature favours the formation of carbonic oxide; and at

about 800° C. and upwards conversion of the greater part of the carbon into combustible gas may be anticipated.

Turning to the semi-producer furnace, its behaviour is much the same as that of the full regenerative setting; but for adequate regeneration the area of the grate must be restricted. On the other hand, regeneration must not be increased unduly at the expense of the grate, as the conditions for the formation of carbonic oxide are in many respects less favourable than with the complete producer furnace. With the latter, there is a constant reducing layer about 2 feet in depth; but in the semi-producer furnace the

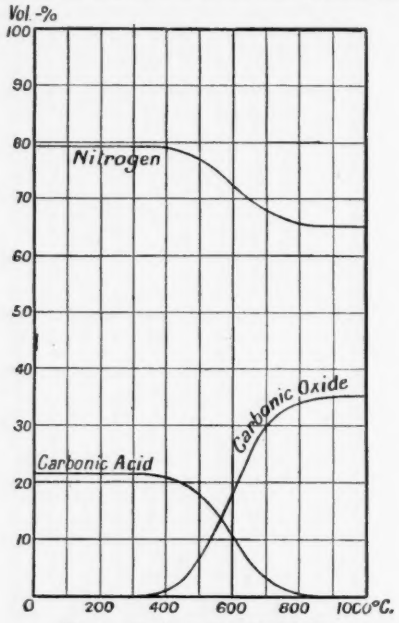


Fig. 1.—Producer Gas Equilibrium.

layer is much shallower. The burning away of the fuel diminishes the depth of the reducing layer, and the carbonic acid which is first produced has scarcely time to react completely with the solid fuel. In this respect the conditions are analogous to those of the direct-fired furnace, though with the latter it was air which passed through unconsumed, and with the semi-producer furnace it is carbonic acid which escapes reduction. The proportion of carbonic oxide in the producer gas varies; and hence the amount of air admitted at the higher level for its combustion should be varied accordingly. At first sight it would seem as though a

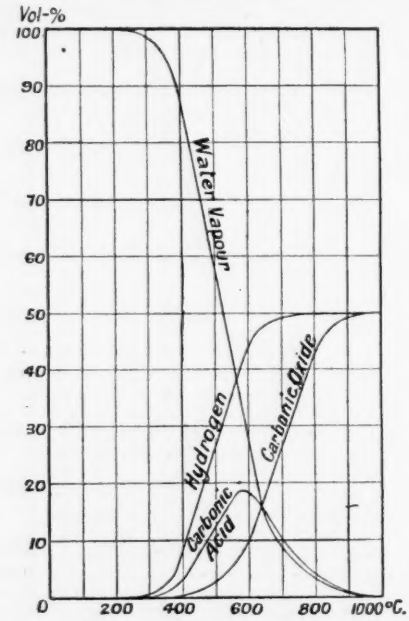


Fig. 2.—Water Gas Equilibrium.

higher grate temperature, due to the smaller admission of steam, would serve to stimulate the reaction; but the steam can no more be dispensed with in the semi-producer furnace than in the regenerative furnace.

The simplest method of controlling the working of a setting is by observing the draught. Secondly, the temperature in the setting may be taken; and this shows the distribution of heat. But the third, and most important, mode of control is the analysis of the products of combustion. The combustion of a given weight of carbon requires a known volume of air, of which, when no steam is used, half is primary and half secondary air supply, if the furnace is of the regenerative type. The supply of air, and consequently the quantity of flue gases, depends directly on the chimney draught, and is inversely proportional to the resistance. The draught must be sufficient to overcome the resistance and draw enough air to the grate. In practice, the draught is made greater than need be, and reduced by a damper, so that there is always some reserve available. The use of a damper acting through the regenerative passages and on the mixing nozzles is attended with disadvantage where, as in most retort-settings, the flame or combustion gases pass straight up the middle of the chamber and then divide into two down-going streams. A momentary small excess of draught on one side draws more combustion gases to it, and so increases the heat on that side. The effect is cumulative. It would be otherwise if combustion took place uniformly below the middle retort and the flue was on the top of the setting, as in old direct-fired settings. In the regenerative furnace, the draught acts through the two sides of the regenerator, on the arch of the settings, and on the nozzles, and consequently on both the primary and secondary air supplies. The latter, therefore, are each dependent on the resistance presented to them. The resistance to the secondary air is the friction of the passages and the damper. The resistance to the primary air is mainly friction in the fuel and in the grate, which is constantly varying, whereas the resistance to the secondary air is constant. As the grate becomes blocked with clinker, its resistance increases; less primary air is drawn in; and less producer gas formed. The draught thereupon acts more intensely on the secondary air supply, and so does twofold harm in that the fuel is decreased and the excess of air increased at the same time. The aim therefore must be to keep the resistance to the primary air supply as far as possible constant. With this object, a large grate-area is adopted, and the ash is prevented from fusing by free admission of steam. The difficulty is greater with the semi-producer furnace, because the friction of the grate relatively to that of the bed of fuel is increased owing to the bed of fuel being shallower than in the regenerative furnace. One means of securing constant resistance to the primary air supply is the use of a damper on this supply; but if such a damper is employed, and the resistance to the secondary air supply is kept constant, the draught will cause the latter to vary. On the other hand, the closing of the secondary air damper will produce a strong in-draught of primary air. The draught to be used must depend on the construction of the setting; and it may be pointed out that the rate of flow in the retort-chamber, and therefore the time which the gases have to impart their heat to the retorts, is independent of the draught. For a given cross section, the rate of flow depends only on the quantity of gases. If a given quantity of fuel is burnt to yield chimney gases containing (say) 18 per cent. of carbonic acid, the quantity of gas is fixed and the pull of the chimney does not affect it; but the smaller the draught the less influence has any unsoundness of the setting. At the same time the regulating effect of the air damper is diminished.

In regard to the temperature observations in the setting, the skilled stoker can judge the uniformity of the heat up to a certain point by observation through the sight-holes; but his judgment is affected by the light outside the setting. The uniformity of the temperature depends on the flame produced—that is, on the gradual combination of the air and the producer gas. Much depends on how the air and the producer gas impinge on one another. When at an acute angle they mix very slowly, if their velocity is considerable. Slow admixture results in a long flame of great volume. The velocity of the air and gas streams depends, however, on the quantity of gas; and this is increased *cæteris paribus* by increasing the admission of steam, though the supply of steam to the furnace presents a further advantage in improving the flame. Producer gas containing much carbonic acid (such as is often formed in semi-producers) carries much heat with it from the producer, and, as it requires but little secondary air for its combustion, forms a short hot flame, such as is responsible for the pitting and overheating of the middle retorts in semi-producer settings. From what has been already said, the possible remedies for these conditions of things will be obvious. The admission of steam to the grate may be resorted to, and the layer of fuel kept high by frequent clinkering; or the area of the grate may be increased, and the current of gas thus retarded; or, finally, too rapid admixture of the gas and air streams may be avoided by structural changes in the nozzles or baffle-plates.

For ascertaining the temperature, a Le Chatelier or Wanner pyrometer is most suitable. Formerly a cherry-red heat of about 900° C. was considered best for carbonization; but higher temperatures are now usual. Very high temperatures, however, introduce so many troubles—such as the formation of naphthalene, a hot hydraulic main, increased formation of carbon bisulphide, and a lower yield of ammonia—that small works at least may be recommended not to use excessive heats. The temperature for horizontal retorts should remain between 1050° and 1200° C.

If the analysis of the flue gases is adopted as a means of checking the working of the settings, it must be carried out regularly, and not merely in a haphazard manner. Too frequently the works manager is content so long as his settings are hot; but analysis of the flue gases would indicate whether a proper economy of fuel was being attained. If, with proper heat in the setting, the flue gases contain 18 or 19 per cent. of carbonic acid, there is generally little reason for making any change. If, however, carbonic oxide is found in appreciable quantity at the inlet of the regenerator, there is loss of fuel which ought to be utilized in the setting.

The annexed table shows the temperature theoretically obtainable and the net duty when the combustion takes place (1) according to theory, (2) with excess of air, (3) with deficiency of air, and (4) with excess of carbonic oxide:—

Condition.	Composition of the Flue Gases. Volumes per Cent.				Limiting Temperature.	Net Duty.
	CO_2.	CO.	O.	N.	Deg. C.	Per Cent.
Theoretical combustion . .	20·0	..	..	80·0	2610	61·7
1-10th deficiency of air. . .	17·4	4·35	..	78·25	1970	49·3
1-10th excess of air	18·2	..	1·8	80 0	2390	58·2
18 p. ct. of carbonic acid with excess of air. . .	18·0	..	2·0	80·0	2370	57·8
Do. with excess of carbonic oxide	18·0	3·3	..	78·7	2240	55·4

Excess of carbonic oxide may, as the table shows, be attended with a consumption of 16 per cent. more fuel. In order to burn the carbonic oxide, more secondary air must be admitted. This may be done by diminishing the resistance at the secondary air damper; but indirectly this may, as already pointed out, cause less primary air to be drawn in, and consequently reduce the consumption of fuel. The setting may therefore not be more highly heated by the change than if the same quantity of fuel were burnt economically instead of uneconomically. It may, on the other hand, be necessary to reduce the fuel consumption by diminishing the draught. If the heat of the setting is satisfactory, but there is too little carbonic acid in the flue gases, the fuel has not only heated the setting but also an excess of air; and an economy may be effected by reducing the draught and diminishing the secondary air supply.

These are the possibilities of economy when the setting is properly heated; but generally the analysis of the flue gases will be applied to test the reason of the heat of the setting being unsatisfactory. When the fuel consumption is high, and the heats are nevertheless low, if analysis shows that the carbonic acid in the flue gases is low, it follows that too much air is being introduced, and the flame temperature is being lowered thereby. An improvement may be effected by reducing the secondary air supply. Should, however, carbonic oxide be found as well as carbonic acid, there is clearly incomplete combustion, and the fuel consumed is not dispossessed of all its heat. Better utilization of the fuel and higher heats will generally be obtained by increasing the secondary air supply. Should the proportion of carbonic acid be satisfactory—viz., about 18 per cent.—and nevertheless the heats continue low, attention should be directed to the clinkering and firing of the furnace. It should always be noted, in taking a sample of gas for analysis, how long an interval has elapsed since the furnace was clinkered and fresh fuel added. The semi-producer furnace should show the most favourable conditions about two hours after clinkering, and shortly after the fire has been made up with hot coke. At times it may be found that during the second half of the interval between two clinkerings the proportion of carbonic acid will be high, and nevertheless the heats in the settings will be low. This may be due to too little fuel being consumed, perhaps because the regenerative system is unsound, and there is a great reduction of draught through it.

Analysis of the gases at the inlet and at the outlet of the regenerator will show whether this is the case. For instance, if 18 per cent. of carbonic acid is found at the inlet and only 12 per cent. at the outlet, it is a sign that one-third of the volume is air which has leaked in. In this case the first thing to do is to make the regenerator sound. If the low heats with high proportion of carbonic acid are not due to leakage in the regenerator, the draught should be increased in order to improve the air supply. The primary air supply should be increased in the first instance, and a further analysis will show whether there is really sufficient secondary air. After making this alteration, the setting should be left for at least a day before re-testing. Another possibility is that more water has been evaporated in the grate than can be decomposed. The surplus steam then passes through the setting, and increases the heat-carrying capacity of the flue gases. A point towards which attention should always be directed is the soundness of the masonry between the grate and the regenerative passages, as clinkering is apt to cause considerable unsoundness. Obviously, if the producer gas can find its way direct to the flues, fuel is being wasted. If carbonic acid is found in the air passages of the regenerator, combustion of gas which has leaked in from the grate is taking place, and signifies loss of fuel.

These are a few of the ways in which analysis of the flue gases can be applied for controlling the working of retort-settings.

Assessment of Gas and Water Works for Income-Tax.—According to the report of the Commissioners of Inland Revenue for the year ending the 31st of March last, the gross income assessed in respect of gas-works in the United Kindom, based on the profits of the preceding year, was £1,735,084, or 31 per cent. higher than in the year 1897-8; the figures being £5,582,771 and £7,317,855. Compared with the year 1905-6, however, there was a decrease of £95,756. The gross income assessed in respect of water-works was £1,388,881, or 32·2 per cent. higher than that for 1897-8; the figures being £4,305.708 and £5,694,589. Compared with 1905-6, there was a decrease of £121,711.

THE PROXIMATE ANALYSIS OF CLAYS.

A recent number of the "Chemische Industrie" contained a communication from Herr H. Bollenbach, describing a new method for the proximate analysis of clays into clay-substance, felspar, and quartz. The following abstract translation of the article is taken from the "Chemical Trade Journal."

The most convenient method hitherto described is that of Berdel, who, in the sample dried at 120° C., decomposes the clay-substance with sulphuric acid dilutes, and after several hours decants the acid solution containing most of the alumina. The residue is then digested with caustic soda solution, which is subsequently decanted, and then with concentrated hydrochloric acid. The extraction with soda and with hydrochloric acid is repeated, and the finally insoluble residue is filtered, ignited, and weighed. The loss is calculated as clay-substance. The residue in the crucible is decomposed by hydrofluoric acid, and the felspar calculated from the alumina or from the alkali thus liberated—the quartz being given by difference. The method is exact but tedious, as the proportion of clay-substance—the first number obtained—cannot be arrived at under three days.

Herr Bollenbach proposes to avoid the tedious extraction of the soluble silica as follows: One gramme of the clay is digested with 20 c.c. of water and a few drops of soda solution in a 400 c.c. Erlenmeyer flask. After a short time 10 to 15 c.c. of sulphuric acid and about 2 c.c. of nitric acid are added; the mixture is heated to boiling, and gradually concentrated with occasional shaking, till white fumes of sulphuric acid arise. The mixture is then cooled, diluted with twice its bulk of water, again cooled, and then made distinctly alkaline with ammonia. The precipitate is filtered, washed, and treated with hydrochloric acid, which dissolves the alumina and ferric oxide derived from the clay-substance. The solution is filtered and made up to 250 c.c., and the alumina (and iron oxide) in 100 c.c. determined by evaporating to dryness—taking up with hydrochloric acid, and precipitating with ammonia. With china clays, the clay-substance—in this case aluminium silicate ($2SiO_2.Al_2O_3.2H_2O$)—can be calculated by multiplying the alumina found by 2·534. With clays which yield a highly coloured precipitate of hydroxides, the iron is estimated volumetrically in another 100 c.c. of the solution, and calculated to $Fe_2O_3\,2SiO_2\,2H_2O$, or returned as free ferric oxide, according as the ultimate analysis may indicate. The insoluble residue from treatment with sulphuric acid, ammonia, and hydrochloric acid is ignited, and the potash (or soda) contained in it determined by Lawrence Smith's method, by semi-fusion with calcium carbonate and ammonium chloride. From the potash found, the felspar present is calculated. Calcium carbonate, if present in the original clay, is determined; and if the percentage of quartz is required, it must be obtained by subtracting from 100 the percentages of clay-substance, felspar, and calcium carbonate found in the clay dried at 120° C. The quartz so determined bears the sum of all the errors; but these, with care, are only small. In any case, the method gives a direct determination of the clay-substance—the most important constituent; and this can be completed in a day.

It is added that these proximate analyses cannot, except in special cases where a tolerably uniform product is being dealt with, replace ultimate chemical analyses; but whereas the latter alone are often useless, the two together give nearly all the information likely to be required.

REPAIRING A SUBMERGED WATER-MAIN.

In a paper read before the American Water-Works Association, Mr. A. W. Cuddebach furnished the following particulars in regard to the repair of a 72-inch steel water-main submerged to a depth of 30 feet. The pipe formed part of the plant of the Jersey City Water Company; the pipe-line (about 21 miles long) extending from a storage reservoir at Boonton (N.J.) across country to the city. It consists of concrete conduits, tunnel, and steel pipe. The portion specially referred to by the author—that running under Hackensack River—was laid in 1902, and consists of 11-16ths inch riveted steel pipe 6 feet in diameter. An abstract of Mr. Cuddebach's paper appeared in "Engineering Record," from which the following particulars have been taken.

The pipe was brought on to the ground in 28-feet lengths, made up of four sheets. These were connected upon the west bank of the river on staging suitable for the purpose, carried out across the river and supported on floats. As the pipe was connected, it was enclosed in reinforced concrete rings, which were made in forms, slipped over the pipe, and afterward grouted; making eventually a continuous concrete covering, the weight of the pipe and concrete covering being just sufficient to sink it. After the pipe composing the river crossing was completed and entirely supported by barges, it was lowered to its final position in a trench prepared for it by dredging.

At the time the pipe was lowered into place, and just as it was filled with water, a break occurred in a field joint at approximately the middle of the river. This break was first noticed shortly after the pipe was lowered and filled, and before the ends were connected to the remainder of the line. After considering

the possible character of the break and the method to be employed in repairing it, it was decided to build bulkheads in each end of the pipe, force the water out by air pressure, and make an examination. After considerable trouble, the contracter who laid the pipe, and who was doing the repairs, succeeded in getting the water out. It was then discovered that the pipe had opened—in other words, a plate had parted about seven-eighths of the circumference of the pipe; the widest opening (2½ inches) being on the bottom. It was repaired by putting a complete ring of steel plate inside the pipe over the break, and fastening this plate with stud bolts. The ring was put on in five pieces, and the repairs finally completed about two months after the break was first discovered.

No further trouble was experienced with the pipe until some time in 1904, when an examination of the river crossing developed the fact that there was a small leak. This was discovered by the sound, which was plainly audible when passing over the pipe in a boat. In November, 1904, a diver was employed to make an external examination of the pipe; but he could not discover any evidence of a leak. Shortly afterwards, it was observed that a considerable quantity of water was being lost between Boonton and Jersey City. The measurement of the water flowing into the pipe was made through sluice-gates at the intake at Boonton, and at the city through a 72-inch "Venturi" meter. The noise made by the leak at the river crossing, however, continued to increase; and the difference in the measured quantities became so great that the loss was between 5 and 6 million gallons daily.

Towards the close of last year, a diver was again employed to examine the pipe from the outside. When this examination was made, it showed that there was a substantial stream of water coming out of the pipe at about 80 feet from the westerly edge of the river, and in nearly 30 feet of water. The diver reported that the stream coming from the pipe was of sufficient velocity and volume to force his body to one side when he passed in front of it; that there was a hole in the concrete covering on the side of the pipe about 10 inches square; and that the velocity was so great that he could not feel the pipe to determine the character of the injury to the steel plates. His description of the leak and the quantity of water being lost was sufficient evidence that repairs should be made at once.

It was at first decided that repairs might be made more economically without the aid of air pressure; and plans were prepared to get at the leak by pumping out the water. The pipe crossing in the river is in the middle of the Hackensack Meadows, and about two miles from the nearest point that could be reached by waggon road, and at least this distance from the nearest place at which power could be obtained. After considering the feasibility of having electric power to operate the pumps, which would of necessity have to be placed inside the pipe in order to deal with the water, it was decided that the cost of obtaining electric power would be excessive, and the difficulty of getting a steam plant there and handling the exhaust-pipes within the main-pipe led to the decision to abandon this method, and effect the repairs by means of compressed air.

Plant of sufficient capacity for the job, together with the necessary boiler power to operate it, was secured, shipped to the river crossing by barge, and set up on the west bank of the river. At about 400 feet to the west of the break, a 48-inch T-piece had been placed in the line when it was built, with a 48-inch valve on either side of it, and a 48-inch valve on the T; also a 48-inch valve on the east side of the river. This afforded means of getting into the pipe without cutting the main line. An air-lock was got and fitted to the flange of the valve in the T-piece, and the plant set up and brought into working order. About 200 feet east of the 48-inch branch, which afforded a means of entering the pipe, and therefore 200 feet nearer the river and the break, was a manhole. As soon as the pressure was off the main line, the cover was removed from this manhole, and another cover which had been previously fitted with a 3-inch tapped opening, through which a 3-inch nipple was screwed, was put on in its place. From this manhole a line of 3-inch screw wrought-iron pipe, which had been previously prepared in suitable lengths, was then connected and carried down the 72-inch pipe towards the break as the water was forced out of the pipe through the break by the pressure of the air. The 3-inch pipe acted as a discharge for the water after the break had been stopped up, and no more water could be forced out that way, and proved of sufficient capacity.

On the 1st of December, the first move was made towards getting into the pipe to determine the nature of the break. The main-line valve on either side of the river was shut down; thus isolating the river crossing, which is about 1000 feet in length. These valves were finally closed at about 2 p.m. Afterwards the 48-inch valve on the branch was opened, and as much water as possible was allowed to run out of this section of pipe through the air-lock. Then this was closed and the compressor started. No difficulty was met in forcing out the water until it attained such a level in the pipe that the air would escape through the top of the break. As soon as this point was reached, the air escaped with such rapidity that no further progress could be made toward forcing out the water. Several schemes were tried before it was finally possible to plug-up the crack sufficiently to hold the air and force out the rest of the water.

It being in the winter time, it was exceedingly unpleasant to wade in water up to one's neck, and by hand plug-up the crack with clay. Large quantities of waste and gasket yarn were floated out on boards in the pipe, and the crack was partially plugged in this way; but this method was found slow and unsatisfactory. Finally the foreman in charge of the work waded out in the water in a diver's suit, and succeeded in plugging the crack, after which there was no further difficulty in forcing out the water sufficiently to allow men to enter and examine the pipe thoroughly. It was discovered that the pipe had cracked about three-fifths of the way round; the crack being on top, and open at its widest part from ⅜ to ½ inch. This work took all one Sunday afternoon, the whole of the next day, and up to 2.30 p.m. the following day (Dec. 3), when it was possible to make an examination and determine the nature of the rupture in the pipe. At this time Jersey City was getting short of water, and so it had to be turned through the pipe again.

Owing to the difficulty of maintaining the supply without the main being in service, and therefore the time for making repairs being limited to practically a 48-hour period, it was seen that it would be utterly impracticable to repair the break in the same manner that the first one had been dealt with. It had been the intention, before examining the break, to make repairs as before—that is, to rivet on patches with stud bolts; but it was then decided that this could not be done without delay, and that repairs must be made in the shortest possible time. The question was how this was to be effected. After considerable discussion of various plans proposed, it was decided to put an internal ring in the pipe; and the first thought was to make this ring of cast iron. After considering the subject in all its phases, especially the difficulty of handling the heavy weight of iron that would be necessary, it was finally determined to make the internal sleeve of steel plate. This sleeve was made up of three steel plates, 2 feet wide and 6 feet long. It was thought that the plates could be bent to form an angle for bolting together. But it was discovered that this could not be done without cracking them; so angles were riveted to the plates to form flanges. Set-screws were put in the plates to assist in adjusting and holding the sleeve in position in the pipe.

Several materials were considered for use as filling between the sleeve and the pipe. A patent cement which would expand on setting was one of the materials chosen; but it was rejected because of the time necessary for its setting, which would have been at least 24 hours. Lead in its usual form was also rejected, because of the impracticability of pouring the joint completely, and the fact that, even if it were possible to pour it, it could not be caulked its entire depth. Lead wool was finally decided upon as the material to be used in filling the joint. This was selected on account of the facility with which it could be handled, and of the fact that it could be placed in the presence of water and caulked-in the entire depth of the joint.

After the first examination of the pipe was made, the actual starting of repairs was delayed for several days until arrangements could be completed to keep up the supply of water to the city while the pipe was out of use. The work was actually started on Dec. 19, 1907. The water was turned off at 8.45 a.m. on this day, and the pipe finally emptied below the position of the break, and the necessary tools, &c., put into it, by 6 p.m, During the night the sleeve was placed in position ready for the filling material. After this was done, the centre of the joint round the row of circumferential rivets of the pipe, where the crack was located, was thoroughly caulked with ordinary gasket yarn smeared with clay, in order to prevent the water working in and getting round the layers of lead wool which were to follow and act as backing for the first layer of lead. Then the filling was continued from either side with lead wool, and thoroughly caulked to within about 2 inches of the outside edge of the sleeve. This space was filled with strips of solid lead, 3 or 4 feet long, which had been poured into moulds the thickness of the joint, and thoroughly caulked. The work of caulking-in the lead wool was begun at 6 a.m. on Dec. 20, and carried on continuously until finished. The water was again turned on about 7 p.m. of the same day; making the total time the conduit was out of service approximately 36 hours. The pipe was tested for leakage when the water was turned on, and found to be tight.

Special home-made caulking-tools were used in placing the lead wool in the joint. The men who actually made the repairs worked in two shifts of five men and foreman for each—two hours in and two hours out of the conduit; the same men working in this way from the start to the finish of the job. The men were all taken from the regular working force of the Company, and were selected for their known qualities of endurance; and to their faithfulness was very largely due the successful completion of the job in so short a time.

Industrial Use of Tar and Pitch.—Messrs. W. J. & A. Malden have taken out a French patent for a process of treating tar and pitch to render them more suitable for industrial uses. According to an abstract of the specification in the "Journal of the Society of Chemical Industry," in order to improve the tenacity, and raise the softening point of tar and pitch, they are treated in the following manner: The tar or pitch, after the addition of a suitable proportion of oil, is heated to about 60° C., and well agitated with about 10 per cent. of manganese peroxide, and afterwards with 5 per cent. of concentrated sulphuric acid. The mixture is then heated to about 180° C., and maintained at this temperature so long that during the last 15 minutes of the heating only about 0·25 per cent. of the material is evaporated.

REGISTER OF PATENTS.

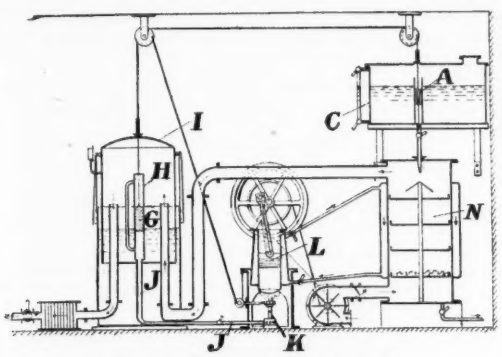
Production of Gas from Volatile Hydrocarbons.

PARKER, T., of Chapel Street, Edgware Road, W.

No. 15,871; July 10, 1907.

This apparatus, for the production of gas from volatile hydrocarbons, is of the type in which the motion of the gasholder bell due to varying consumption of gas is employed to regulate the supply of liquid to the carburettor and also the carburetted air to the burner of the motor driving the air-pump or blower, and whereby also the lowering of temperature due to the evaporation of the petrol and the subsequent decrease in volatilization may be prevented.

The arrangement shown for regulating the supply of benzol consists of a weight A suspended within a slotted or perforated tube passing through the bottom of the benzol tank C and connected to another weight G suspended within a slotted tube H in the gasholder bell I. The tube H is connected at its lower extremity by a pipe J to the burner K of the hot-air engine L, which is employed to drive a fan or blower for supplying air to the carburettor N. The exhaust from the engine is advantageously passed through a jacket surrounding the carburettor, by which means the temperature of the latter is rendered uniform.



Parker's Hydrocarbon Gas-Plant.

The bell of the holder rising owing to the consumption of gas decreasing, lowers the weight A so as more or less to cover the perforations in the tube surrounding it, and thus decrease the flow of benzol, while similarly on the bell I lowering the weight A will be lifted so as to increase the supply of benzol to the carburettor N, so that the supply of gas to the burner under the hot-air engine will be simultaneously regulated by means of the weight G.

Means are, moreover, provided whereby the supply of air to the carburettor N may also be regulated according to the consumption of gas—by providing the burner of the hot-air engine with an automatic igniter, which is also connected to the weight suspended within the gasholder bell. Thus when the bell rises beyond a predetermined limit, the burner is extinguished by reason of the supply of gas being cut off by the weight G, while upon its fall beyond another predetermined limit the automatic igniter is brought into operation to light the burner.

Treatment of Alkaline Effluents.

RADCLIFFE, J., of East Barnet.

No. 18,135; Aug. 10, 1907.

In patent No. 10,075 of 1905 (by the same inventor) processes were described for the continuous treatment of spent liquors containing such quantities of sulphocyanides as to render their removal both necessary and profitable. The present invention consists principally in applying a similar process of acidification to such effluents as can be discharged without special treatment for the recovery of sulphocyanides. This acidification is effected continuously by passing under constant pressure the two or more liquors neutralizing each other through holes in some unwearing material, suitably adjusted as to size. Or the acidification may be effected by pumps working on the same shaft, or at fixed rates, so as to deliver the same comparative quantities.

The acid employed may either be sulphurous acid which may be a bye-product, or may be produced from a bye-product of the same operation as that which produced the alkaline effluent. For instance, in the working up of ammoniacal liquor sulphuretted hydrogen is produced as a bye-product; and of this a sufficient portion, in the form of sulphurous acid, to acidify the liquor can be taken, and the remainder dealt with by any suitable means. Or sulphur dioxide may be produced by burning sulphur in the form of a sulphide—such, for instance, as iron pyrites or brassy coal—or from iron oxide which has been employed for arresting sulphuretted hydrogen, and injected into the liquor or dissolved in water and subsequently added, or the liquor may be passed through a tower with the gases. When the sulphur dioxide is produced by the combustion of a solid, the continuous production of a correct amount is ensured by delivering the material to be burned by a worm or like mechanical means, or an excess of solid material may be burned and the required amount of sulphur dioxide dissolved and added to the effluent to be acidified by passing a fixed amount of liquid for dissolving the gas, which may be accomplished by passing the liquid through a hole of the required size at a constant pressure. Any excess of sulphur dioxide may be absorbed by passing it through calcium oxide or carbonate in a moist condition. The acidification is desirably such that a minimum of free acid is left in the effluent; and the regulation of the amount of acidity may be effected by means of a cock on the sulphuretted hydrogen pipe when the acidification medium is produced from sulphuretted hydrogen.

Manufacture of Fuel ("Coalite").

PARKER, T., of Chapel Street, Edgware Road, W.

No. 15,872; July 10, 1907.

This invention relates to the treatment of ordinary gas coke "in order to render it easy of ignition and capable of free burning, so that thus it may be used as a domestic fuel in substitution of coal."

It is proposed to discharge the hot coke as it leaves the retort into a tank containing heavy tar oil or "other suitable liquid hydrocarbons" or other material on the surface of which is floated a layer of water whose thickness is determined (for example) by allowing 1 inch of water per hundredweight of coke to be quenched—the amount of oil or hydrocarbons used being sufficient practically to cover the coke shot in. The impact of the red-hot coke with the water, it is said, gives rise to violent ebullition, quenches the exterior of the coke, but leaves the interior still hot. On reaching the oil, the latter penetrates to the hot core, and is partly vaporized and partly decomposed, and is driven into the pores of the coke. The water is then run off from the top of the oil, through a floating outlet or otherwise; and the oil is drawn from the bottom of the tank, leaving the coke still at a temperature of "about a little over the boiling point of water, so that thus it quickly dries." Coke so treated, it is pointed out, ignites easily and burns with smokeless combustion.

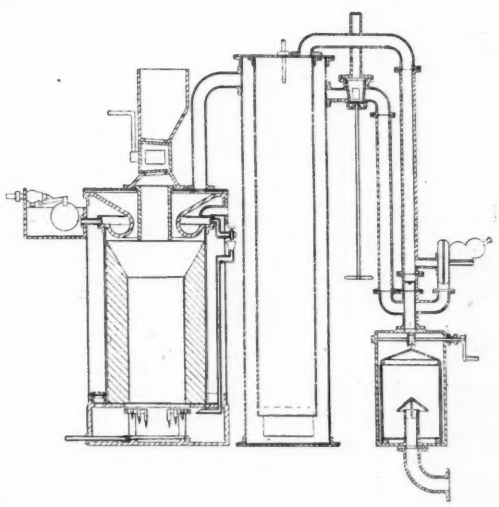
Several hydrocarbons having a flash point of over 250° Fahr., might be used, the patentee remarks, for the purpose of the invention; but he prefers heavy tar oil, "as its high specific gravity ensures the water remaining as a layer on the surface, and the heavy tar oil itself is of such low commercial value as to be the cheapest material to use." He says he is aware that it has before been proposed to spray coke with such oils; but if the coke be hot this gives rise to ignition, while if the coke be cold the lower portions of the mass are oily and unfitted for use. The plunging of coke into tar oil has also been suggested; "but here again, if the coke be at a sufficient high temperature to obtain any useful effect, the whole mass is liable to ignite."

Suction-Gas Producers.

BENNETT, F. I., of Macclesfield, and TAPLEY, W., of Southampton.

No. 20,233; Sept. 11, 1907.

This apparatus consists of two main parts, the generator, in which the gas is actually produced, and the scrubber, in which it is cooled and purified.



Bennett and Tapley's Suction-Gas Producer.

The generator consists (as shown) of a base in the form of a cylindrical metal box, in the top of which is a circular hole somewhat larger than the furnace which it supports. On the bottom of the box is placed a stand carrying a set of fire-bars; the stand with the fire-bars being capable of being partially revolved about the centre of the box by a handle or lever projecting through the base of the generator, so as to loosen and break up any clinker that may form.

On the box is fixed the furnace, which consists of a metal case lined with fire-brick. To the top of the case is fixed the vaporizer consisting of a circular metal trough projecting inwards. The inner rim of the trough is extended outwards and upwards over the outer rim in the form of a tun-dish. An outer metal case is fitted concentric with the furnace, and extends from the edge of the tun-dish down to the base—an annular space being left between the cases.

The air is taken in through the top of the outer case by pipes, the ends of which are sealed by dipping into the trough. Ports are left in the top of the cylindrical box supporting the furnace, which allow steam and air to be drawn from the annular space between the cases into the base of the generator under the fire. The top of the generator is a circular metal plate through which is fitted a fuel-feeding hopper. The gas is also led away to the scrubber through a hole in the top of the generator.

The feed-water for the vaporizer is taken in a pipe through the outer case; the level in the trough being kept constant by a float feed chamber outside. An overflow pipe from the trough, regulated by a cock, is also brought through the case, so as to control the amount of steam raised.

The gas is taken from the top of the generator to the scrubber, which consists of a metal cylinder closed top and bottom. The gas enters through a hole in the side at the top. Inside and concentric to this cylinder is another smaller cylinder, closed at the top, but opening at

the bottom into the outer cylinder. The inner cylinder is nearly filled with coke, and is provided with a water spray. The outer cylinder is left empty, and forms a cooling chamber. The gas leaves the inner cylinder at the top by a pipe carried down to an oil purifier. The overflow from the washer is carried away through a water seal-box in the usual manner.

Immediately after the washer, on a bye-pass to the gas-pipe is fixed the starting-fan, which is gas-tight, and which will either deliver into the blow-off chimney or to the engine in which the gas is to be used—the change being effected by a suitable cock or cocks.

The oil filter consists of a box partly filled with any suitable oil, in which are hung a number of porous screens placed so that the gas in passing through is brought into contact with a large surface of oil, and thus dissolves any remaining traces of tar.

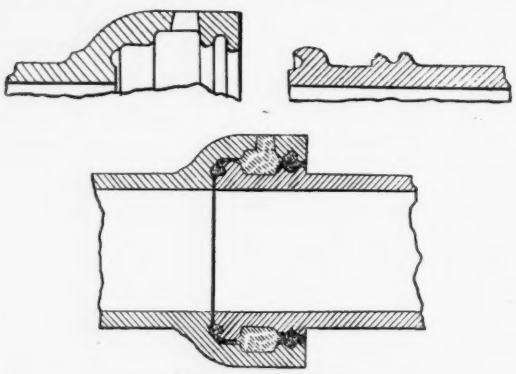
The action of the producer is as follows: A fire is lighted in the furnace and drawn up to a suitable heat by the fan; the fumes being driven off through the blow-off chimney. The temperature of the water in the vaporizer trough is raised; and the steam thus formed mixes with the air drawn in at the top of the outer case. The mixture being sucked through the fire by the fan is converted to gas in the usual way. The quantity of steam raised is regulated by the amount of water allowed to overflow from the trough. The greater the overflow, the smaller the quantity of steam. As soon as gas of the required quality is coming through, the blow-off cock is shut; and the producer will then continue to supply gas so long as suction is maintained by the engine using it, or by other means.

Joints of Pipes or Mains.

YARROW AND COMPANY (BOLTON) LIMITED, and YARROW, M., of Bolton.

No. 18,446; Aug 15, 1907.

In carrying this invention into effect, the spigot end of the pipe is formed with two annular flanges extending laterally from the body part. In the lateral flange at or near the extreme end of the pipe is formed an annular groove in the direction of the length of the pipe in such a manner that the outer end of the pipe adjoining the interior of this annular groove projects beyond the other part of it on the outside of the annular groove, so that when the pipe is placed to rest upon this outer end (as when in its fictile state) it does so without damaging the part adjoining.



Yarrow's Pipe-Joint.

The peripheral surface of the other annular flange is made (as shown) at an angle to the body part of the pipe, so as to fit within the outer opening of the socket part of the pipe where it adjoins another inwardly projecting annular flange formed on this socket part. The inner surface of the flange is also of a bevelled shape, so that the opening between it and the flange on the spigot is of dove-tail or other shape in cross section—being larger at its inner than at its outer part. The socket of the pipe is further formed so that an annular groove may be formed within it and endwise (or in the direction of the length of the pipe), so that on the spigot part being inserted in it the annular groove made in the one will fall opposite, or be in alignment with, that in the other. Thus, when the joint has to be formed, an annular piece of clay, tow, hemp, india-rubber, or other pliable substance may be placed in one of the annular grooves to extend—when the spigot end of the pipe is inserted into the socket—into the other annular groove. In this way, a joint is formed which is sufficient to prevent the joint-forming liquid or substance from passing or escaping into the interior of the pipe on the joint being formed.

The illustration shows a longitudinal section of the socket and spigot ends of a pipe or main constructed in accordance with this invention; also longitudinal sections of portions of the socket and spigot parts of the pipe or main, shown as detached from each other, in order that the particular shape of their several parts may be more readily seen.

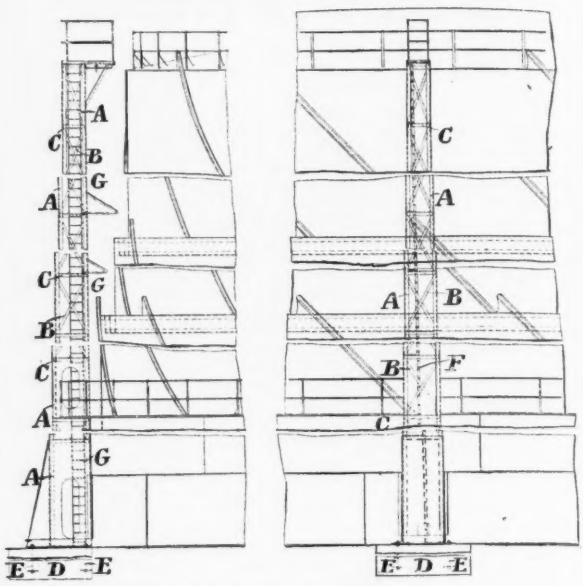
Ladders for Spiral-Guided Gasholders.

RILEY, E. C., and SLATTER, D. G., of Swindon.

No. 21,515; Sept. 28, 1907.

The object of this invention is to provide means whereby access can be obtained to the crown of the top section of a telescopic holder when the sections are out to their fullest extent or when partly extended; also means for ascending to the crown, to enable the lutes of each section to be readily examined, and to serve the purpose of supporting pipes used to convey water, steam, or anti-freezing mixture to the cups or lutes.

The invention consists broadly in the construction of a mast—preferably in the form of a channel in cross section; the open portion of the channel facing the outside of the holder sections, and a ladder leading from the base to the top of the mast—suitable means being provided in the open portion of the channel for supporting portable or



Riley and Slatter's Gasholder Ladders, &c.

fixed platforms from which anyone could examine the lutes or roller brackets, or from which access could be obtained to the crown of the top section of the holder.

In one form proposed, the patentees construct the mast from four angle-irons A suitably cross braced on the three sides by bars B; the three sides being also stayed at suitable distances by horizontal angle-iron stays C, and the open portion by angle-iron stays—continuations of the angle-iron stays C. The top of the mast as well as the base has a frame of angle-iron. The lower portions of the members of the mast are connected by metal plates, and the base held down by bolts E to suitable foundations such as D. In the arrangement shown, the gasholder tank is above the ground level; the portion of the mast coinciding with the height of the tank; while the gallery on the top of the tank is secured to the side of the tank by any suitable means. The mast is in the shape of a truncated pyramid; and the open side nearest the holder is preferably vertical.

The ladder is constructed with metal sides F, rectangular in form, and the rungs G from metal bars. At the top of the mast and extending therefrom is an angle-iron framing, on the extended portion of which is formed a platform by means of bars. Suitable stays are connected with the framing of the platform and the angle-iron member of the mast. A hand railing is provided, passing around the three sides of the platform; the front being protected by a rail hinged so as to be lifted up out of the way when required.

On the underpart of the platform is arranged a T iron beam having both ends secured to the framing of the platform carrying a running block, to the hook of which is connected the hook of lifting appliance for the purpose of raising articles to any part of the holder when required or for raising the portable platforms next to be described.

These portable platforms are fixed on the open side of the mast, opposite the holder; and are capable of adjustment over various sections of the mast so as to be secured by the horizontal stays. In the construction shown, the platform is comprised of two horizontal brackets, each having one diagonal stay formed integral therewith. A hooked end is formed on the end of the horizontal bracket and stay respectively for passing over the angle-iron stay and the angle-iron members of the mast for the purpose of retaining the platform in position. The floor of the platform is of wood resting on the flanges of the horizontal bracket, and strips are secured to the under part of the floor of the platform so as to keep the angle-irons from closing inwards. In order to adapt these portable platforms to various positions, there are various width floor pieces and various length brackets.

The pipes conveying water to the cups or lutes are secured inside the mast, and are preferably boxed in with wood. Pipes can also be carried up the mast for leading steam or anti-freezing mixture to the lutes for the purposes of preventing the water freezing in cold weather.

Production of Gas for Lighting and Heating Purposes.

BROAD, C. C., of Great Malvern.

No. 1643; Jan 23, 1908.

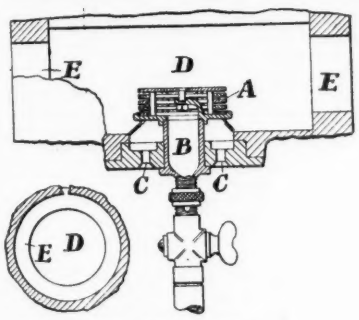
This is a "patent of addition" to No. 1780 application, dated Jan. 23, 1907; and the inventor claims: In apparatus for generating combustible gas by vaporizing petrol or other spirit by atmospheric air as claimed in the 1907 patent, providing the air inlet of the fan or blower by which air is supplied to the carburettor, with a valve which is positively controlled as to its movements in both directions by, and moves in unison with, the bell of the regulating gasholder of the system. The use or application of the air inlet regulating valve referred to in the preceding claim, in association with an air-delivery system in which there is arranged between the fan or blower and the carburettor a main or generating air-delivery pipe and means for optionally admitting a supplementary or diluting supply of atmospheric air to the generator—both the generating supply and the diluting supply (when admitted), as well as the admission of air to the fan or blower, being under the positive control of a regulating gasholder.

Gas-Burners for Heating Apparatus.

VAN ZANDT, E. G., of St. Louis, Missouri, U.S.A.

No. 6763; March 26, 1908. Date claimed under International Convention, March 26, 1907.

This invention relates to that class of gas consuming device which comprises an initial burner having a super-imposed perforated open-ended cylindrical attachment, transversely arranged, in which the combustion takes place; the resulting heat being diffused by the heated cylindrical attachment. In attachments of this kind, it has been found, the patentee points out, that some of the heavier heat-producing elements of the gas escape into the atmosphere unconsumed; and the object of his invention is to construct the attachment to the initial burner in a way which ensures the heavier or heat-producing elements of gas being retained in the shell until consumed, and the lighter or "poisonous elements" in the gas, such as acetylene, "be restrained from rapid escape from the shell, but escape gradually therefrom in such manner that the poisonous matter in the acetylene will be consumed by combustion at the exterior of the shell." This object is effected by restricting the end openings of the shell and forming it with a narrow slot instead of the perforations heretofore made use of.



Van Zandt's Gas "Logs."

A is an initial burner, "of any suitable construction," supported by a neck, into which gas passes from the pipe below to enter and escape from the said initial burner. The member surrounding the neck B is provided with air admission ducts C. D is the burner shell supported on the air inlet and within which is the initial burner A. The shell is of tubular form, and has a "rugged exterior surface to resemble a log of wood," and the channel therein extends horizontally. In the upper portion of the wall of the shell is a V-shaped slot, as a vent. The ends of the shell are formed with internal circular flanges E which contract the channel of the shell at its ends and produce restricted end vents, so as to prevent any inflow of air through the ends during the operation of the burner.

When in use, one or more burners are inserted in an ordinary grate or stove, and the gas to be consumed escapes from the initial burner A into the shell D, and the heavier elements of the gas are consumed by combustion in the chamber or channel of the shell. These heavier elements, it is pointed out, are those from which the heat is derived in the combustion of gas; and they are confined in the shell chamber—due to the top and end vents being restricted, as a consequence of which the heavier elements in their outward movement away from the initial burner strike against the longitudinal wall of the shell and against the shoulders of the flanges E. The "lighter, poisonous elements" which are given off from the gas being of less specific gravity than the heavier elements find gradual egress from the shell chamber through the vents provided, and, "owing to the high degree of heat at which the shell is maintained by the combustion of gas in its chamber, such lighter elements are kept constantly ignited as they emerge through the top and end vents, and are completely consumed before there is a possibility of being dissipated in the atmosphere."

APPLICATIONS FOR LETTERS PATENT.

17,738.—SOCIÉTÉ ANONYME "PARIS-IGNICOLE," "Carburettor." Aug. 24.

17,779.—MARTIN, J., "Admitting charge under pressure for four or two cycle explosion engines." Aug. 25.

17,940.—HOWARD, J. E., "Force-pumps for testing." Aug. 26.

17,974.—TATTERSALL, H., and SUTHERS, C., "Regulator for gas." Aug. 27.

17,978.—CROSSLEY, W. J., and RIGBY, T., "Recovery of certain bye-products in gas-producer plants primarily designed for recovery of ammonia." Aug. 27.

18,008.—STOPPARD, S., "Gas taps or cocks." Aug. 27.

18,037.—PIRRIE, W. H., "Gas-cooking stoves." Aug. 27.

18,058.—DEARING, J. W., "Automatic burner controllers." Aug. 27.

18,083.—COX, J. B., "Utilizing gas for the treating of hot plates." Aug. 28.

18,091.—PURVES, T. H., "Combined stopcock and governor for gas." Aug. 28.

18,093.—POTTER, W. G., "Inverted burners." Aug. 28.

18,094.—POTTER, W. G., "Lamps." Aug. 28.

18,097.—WINTER, T., "Safety device for automatic meters." Aug. 28.

18,110.—AKT.-GES. FÜR KOHLENDESTILLATION, "Coke-quenching apparatus." Aug. 28.

18,122.—MARKS, R. G., "Gas-ovens." Aug. 28.

18,129.—KIRKHAM, HULETT, AND CHANDLER, LTD., and HERSEY, S., "Effecting intimate contact of liquids and gases." Aug. 28.

18,134.—SCOTT-SNELL, E., "Carburetting and storing air for lighting and heating." Aug. 29.

18,172.—HARRIS, H. W., "Controlling lighting and extinguishing of gas." Aug. 29.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Carbonizing Principles and Practices.

SIR,—Is it not somewhat late in the day to discuss the transference of heat as applied to the distillation of coal in retorts?

It is assumed in your "Editorial Notes," Sept. 1, that the character of the coal at the core of the charge remains unaltered for a large period of the time allotted for carbonization—altogether ignoring the fact that there must be two or more distinct streams (excuse the term) of ether moving from the body of the setting to the low-temperature coal within the retort, a portion being absorbed by the containing vessel, the remainder passing through the cells in the wall of the vessel to the coal. If the retorts are of the proper design, sufficient heat must reach the core, from all points of the circumference, to be focussed at one or two points, governed by the shape of the curved section—to speedily render the coal a pasty mass. It is possible the outer layer of coal may be carbonized somewhat earlier in the period, due to the action of the two forces "conduction" and "radiation;" but experience proves, at any rate with heavy charges in horizontal retorts, that the difference in the rate of distillation of the inner and outer layers is only a small fraction of time.

I examined the coke from the vertical retorts at the Oberspree works, Berlin, which I found of about the same density and colour as that taken from round horizontal retorts charged nearly full at these works. It is an undoubted fact that the evolving gas does pass through the coke and deposit carbon—the quantity of such deposit depending upon the temperature of the mass.

It is impossible to place a retort in such a position as to theoretically keep it full. The charge will "shrug its shoulders," and move slightly from the side of the retort, leaving only points of contact. But the time the gas is in contact with the heated surface must be shorter; and, given equal heating and fully charged vessels, good results must and do follow.

Dorking, Sept. 4, 1908. SAMUEL CARPENTER.

LEGAL INTELLIGENCE.

Unlawfully Obtaining a Supply of Gas.

The explanation of John Cook, when accused at the Alford Petty Sessions of unlawfully obtaining a supply of gas from the Mablethorpe Gas Company, was that what he had done was with the idea of "getting his own back." He pleaded guilty, and said that he had been committed to Lincoln Prison under a writ of attachment for money which he did not owe the Company, for whom he was formerly Manager and Engineer. In 1900, the Company obtained from Parliament a Provisional Order under which they were authorized to charge 5s. 3d. per 1000 cubic feet for gas; but during the time he was away from home, the Company unlawfully charged his wife at the rate of 5s. 7d. per 1000 feet. He also alleged that the judgment against him in connection with the debt of £240 for which the writ of attachment was issued was obtained without his having received any notice; and he had applied to the High Court for the notes of evidence against him. Of the debt of £240, some £96 was due to him for services rendered. He was discharged from the service of the Company on a false accusation. He asked the Magistrates to take his circumstances into consideration. Mr. Bloomer, who appeared on behalf of the Company, stated that on Aug. 18 Mr. J. W. Rann, who was Manager to the Company, had occasion to visit the house kept by defendant's wife at Mablethorpe, to examine the gas-meter. Mrs. Cook suggested that it was not convenient for him to do so. However, Mr. Rann insisted on seeing the meter; and he then found that it had been disconnected, and that gas was being used without being registered. The Bench fined defendant £2, with costs.

Theft of Gas-Fittings.—At the Old Street Police Court on the 20th ult., Albert Pitman (aged 25) was charged with stealing a double-pendant gas-bracket of the value of 15s., the property of the Gaslight and Coke Company, from a house in Norah Street, Hackney. Accused and another man were seen by a constable to force the door of the house in question; and through a window they were subsequently observed with the fittings on the floor of a basement room. On the constable entering, they made their escape; but Pitman was captured. Evidence having been given by a clerk of the Company as to the ownership of the pendant, it was stated that a prepayment gas-meter on the premises, also their property, had been broken open. A previous conviction having been proved against the prisoner, he was committed for trial.

Batley Coal Contracts.—When the Batley Gas Committee recommended the letting of the contracts for gas coal for the next twelve months at 9d. per ton less than was paid last year, and pointed out that the whole of the orders would go to local collieries, Mr. Sykes, a Labour member, proposed that the Committee's minutes should be referred back as a protest against Alderman Illingworth's action in sitting on the Committee when the tenders were under discussion. Mr. Illingworth, he said, was Chairman of a local Colliery Company to whom an order for gas coal had been given. As he refrained from voting, he had the law on his side; but a member could wield more influence in the committee room than his own vote was worth. Alderman Ward stated that Mr. Illingworth took no part in the discussion in respect to the contract with the Roche Colliery Company. He had been of great assistance to the Committee; and the town had benefited. Only three members voted for the amendment; and the contracts were ordered to be sealed forthwith.

MISCELLANEOUS NEWS.

MELBOURNE METROPOLITAN GAS COMPANY.

The Half-Yearly General Meeting of this Company was held in the Offices, Flinders Street, Melbourne, on the 27th of July—Mr. JOHN GRICE, the Chairman of the Company, presiding. There was a large attendance of shareholders.

In the report presented by the Directors, it was stated that the net profits for the six months ending the 30th of June, including a balance of £2623 brought forward, amounted to £69,472. From this sum they had transferred £20,000 to the reserve fund, £2500 to the meter-renewal fund, and £1500 to the gas-stoves, &c., account; and they recommended the payment of a dividend at the rate of 5s. per share, amounting to £42,860; leaving a balance of £2612 to be carried forward.

The CHAIRMAN, in moving the adoption of the report and accounts, said the operations of the Company for the half year to which they referred showed continued progress and improved financial results. The total receipts were £228,036, against £208,965 for the six months ended June 30, 1907—an improvement of £19,071, made up of increased sales of gas (£12,265) and higher returns from residuals, principally coke (£6810). The actual quantity of gas sold was 756 million cubic feet, compared with 708 millions for the first half of 1907; representing an increase of 6¾ per cent. Prepayment meters were accountable for a consumption of 46,437,000 cubic feet, compared with 27,147,000 cubic feet for the corresponding period of last year. The cash value of the gas so sold was £11,609, against £6787. This branch of the business continued rapidly to extend, and represented an appreciable addition to the returns from the sale of gas. From the initiation of the system in October, 1904, to the end of June last, the Company had installed 9851 slot-meters; being an addition of 3342 in the past twelve months. Collingwood and East Melbourne had now been added to the districts to which the Company's operations had been extended. From the readiness to take advantage of the prepayment system, which had been continuously displayed since its introduction, it was apparent that the conveniences of light and cooking facilities so afforded were thoroughly appreciated. The installation originally provided only for a small breakfast cooker for domestic use; but, in order to meet what proved to be a genuine demand, the ordinary stove had been made available, on the usual hire and hire-purchase conditions. This innovation had proved most acceptable; adding to the comfort of the consumer, and accounting for increased business to the Company. To properly realize the significance of the figures he had quoted, it was necessary to bear in mind that the Company did not instal slot-meters in cases where gas was being consumed by means of ordinary meters; so that they had in less than four years obtained close upon 10,000 absolutely new consumers through this medium alone. During the current half year it was hoped to arrange for an even more rapid extension of the system. With regard to residuals, the demand for coke had been exceptionally heavy. The Company had in the period covered by the report sold 39,329 tons, against 31,456 tons in the first half of 1907. The proceeds realized had been greater; and the half year was finished with only 247 tons on hand. With a view to the conservation of stocks, the Company had not disposed of so large a quantity of tar during the half year, though the demand for it had augmented rather than diminished. The cost of coals showed an increase of £7895 for the period under review, due mainly to heavier purchases to meet the larger output of gas. While, however, in the cost of providing additional coal there was a rise of some 7 per cent. compared with the six months ending June, 1907, it was pleasing to be able to draw attention to what was a source of gratification to the Directors, and could not fail to interest the shareholders—viz., that carbonizing came to £300 less, though the total quantity of coal used at the works was 7060 tons more; the actual cost being £13,220, compared with £13,520 before. This was the result of the adoption of improved appliances in the process of manufacture, and was a justification of the large amount of expenditure involved. Repairs and maintenance of works and plant constituted a heavy item, and was likely to remain so for a considerable time, as the Directors were "putting their house in order," which during the lean years they were not able to do. Wages and repairs, &c., showed moderate increases over last year; but in each case they were due to the larger number of consumers and to the cost of giving greater individual attention to them. Everything possible was being done to assist in the discovery and removal of troubles arising from faulty fittings, or, indeed, from any cause whatever, with the result of giving increased satisfaction to their customers. The balance of £87,898 carried to the net revenue account was higher by £7281 than for the June half of 1907. Of the amount available for distribution, £20,000 had been transferred to the reserve fund; but, as the Directors had been compelled, since December last, to withdraw from this fund a sum of £31,076, it was now reduced by £11,076. As in the current half year the balance in respect of the new works at South Melbourne would have to be provided for, over and above the necessary current capital expenses of the Company, it would be quite apparent that heavy contributions from the profits would be called for in December, in order that the amount by which the reserve fund account had been reduced might be replaced. A transfer of £2500 had been made to the meter-renewal fund, to maintain this account in credit, and the stoves, &c., account had been written-down by a transfer of £1500 from the net revenue. The volume of business for which the stoves and fittings department had been responsible during the half year was unusually heavy. The number of stoves sold was practically double that for the corresponding period of last year; while the stoves on hire had also been largely added to. The other gas appliances—such as fires, boiling-burners, gas-irons, &c., all of which assisted in developing the Company's business—had received full attention, and the numbers disposed of were constantly increasing. He was pleased to state that the reconstruction of the northern portion of the South Melbourne retort-house had proceeded satisfactorily; the work being now practically finished, and a portion of it in operation.* As he explained at the previous meeting, this work had been of greater magnitude than the reconstruction they completed last year of No. 2 retort-house at West Melbourne. As originally arranged, the South Melbourne house contained a bench of retorts down the centre, with the coal-stores on either side; the retorts being heated by direct-fired furnaces. In the new arrangement, the bench had been built within 22 feet of one side of the house, and the coal-stores concentrated on the other. The reconstruction afforded much better facilities for the handling of coke, and had also given increased coal storage. The installation comprised twenty beds, each containing eight horizontal retorts, heated by regenerative furnaces, and charged and discharged by De Brouwer machinery, similar to that adopted at West Melbourne. The whole of it, including the coal elevators and coke conveyor, was driven by electricity, the current for which was generated by gas-engine-driven dynamos, placed in a power-house conveniently situated in another part of the works. The cost of the new installation to date had been £39,632; and it would produce 2 million cubic feet of gas per day. The new machinery was expected to be completed, and to be fully in operation, in the course of about three months. At the meeting in January, he referred to the probability of having to go on with the reconstruction of the southern part of the retort-house as soon as they had finished the northern portion. Considerable developments were, however, taking place in England and on the Continent in regard to gas-making plant, especially with the new system of vertical retorts, which appeared to be very economically worked. Of these installations reports were forthcoming from the Continent; and the Directors were advised that it would be better to postpone further reconstruction work as long as possible, in order to see whether the new system could be advantageously adopted. Since, with the existing plant, they could manufacture sufficient gas for the estimated maximum output in the winter of 1909, they had decided to temporarily delay the reconstruction of the portion of the retort-house referred to. The Directors were pleased to inform the shareholders that the new installation of retort settings and machinery at the West Melbourne works, which had been in action since October last, continued to work well, and was yielding the results anticipated. In addition to the increased quantity of gas mentioned as having been made at the same cost, the new furnaces were producing greatly improved coke returns; the quantity of coke made for sale per ton of coal carbonized being 11¼ cwt., compared with 9¼ cwt., or equivalent to a net increased production for sale of 3700 tons for the half year, which was an undoubtedly good result.

The Hon. THOS. LUXTON, M.L.C., in seconding the motion, said the shareholders must feel gratified at the remarks made by the Chairman. Everything pointed to progress. Even the slot-meter system, which some shareholders had felt doubtful about, showed an enormous increase; for there were now 10,000 more consumers under this system than there were twelve months ago. The earnings were, no doubt, extremely good. During the past six months, the profits had been sufficient to pay a dividend at the rate of 15 per cent. They were greater this year than last by upwards of £6000. From the splendid position in which the Company now stood, an increase in dividends could naturally be expected.

The motion was carried unanimously.

The dividend recommended having been declared, votes of thanks were accorded to the Directors, the Secretary (Mr. John Hinde), and the staff, and the proceedings closed.

BARNET DISTRICT GAS AND WATER COMPANY.

Retirement of the Engineer.—Issue of Further Capital Sanctioned.

The Half-Yearly General Meeting of this Company was held on Monday of last week, at the Holborn Restaurant, W.C.—Mr. A. H. BAYNES in the chair.

The SECRETARY (Mr. Ernest W. Drew, F.C.A.) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read.

The CHAIRMAN said he did not intend to occupy the time of the shareholders by any lengthened remarks; but it might, he thought, be interesting to bring before them a few figures contrasting the results of the business of the Company for the half year just closed with those of the corresponding period of 1907. Dealing first with the gas department, the gas made during the past half year was 69,286,000 cubic feet, or an increase over the first six months of 1907 of 6,194,000 feet. The quantity of gas sold was 63,244,300 cubic feet, an increase of 5,282,300 feet, or nearly 10 per cent. The coal carbonized amounted to 6185 tons, or 355 tons more; and the average cost was 17s. 9d. per ton, which was 1s. per ton more than for the year 1907. There were 5890 chaldrons of coke made, or an increase of 338 chaldrons; and the quantity sold was 4938 chaldrons, or 552 chaldrons more. The average price realized for the coke was 10s. 9d, per chaldron, which represented an increase of 1s. 3d. per chaldron. The tar made was 80,616 gallons, or 9141 gallons more; the quantity per ton of coal being 13 gallons. There were 63 tons of sulphate made, which was an increase of 3 tons as compared with the previous year; but the price realized was only £7 12s. 2d. per ton, while in 1907 it was £7 13s. 4d. The gas-rentals during the past half year amounted to £11,739, or an increase of £986. The receipts from residuals were £659 more; the main increase being £613 from the sale of coke. The total receipts of the gas department for the six months amounted to £16,286, compared with £14,565 in 1907, or an increase of £1721. Turning now to the gas expenditure, it would be seen that this increase in the receipts had been more than absorbed; the increase in the expenditure having amounted to £2164. This increase was mainly due to outlay under the following heads: Coal cost £618 more; carbonizing wages, £152 more; repairs and maintenance of works, £761 more; repairs and maintenance of mains, £259 more; and law and parliamentary expenses,

* Some particulars (with illustrations) of the Company's works, supplied by Mr. Philip C. Holmes Hunt, the Engineer, were given in Mr. Maurice Graham's article, "Round the World—And Some Gas-Works," in the last number of the "JOURNAL" (p. 575).—ED. J.G.L.

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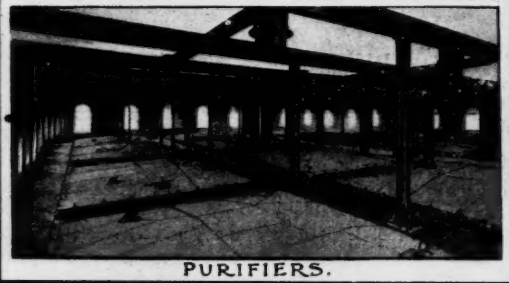

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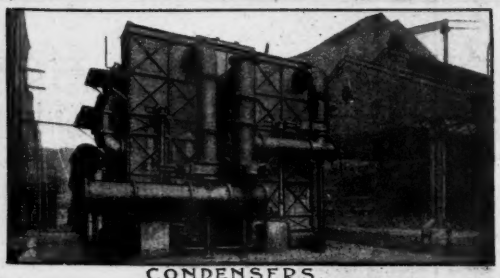

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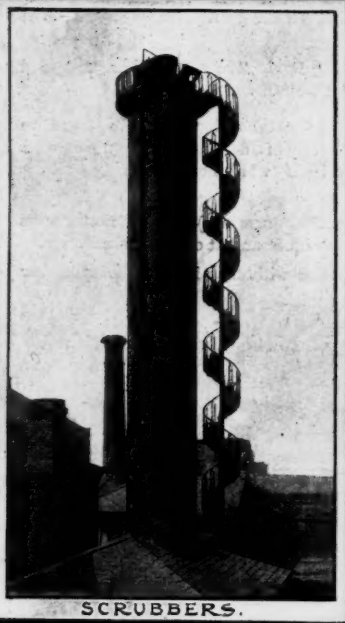

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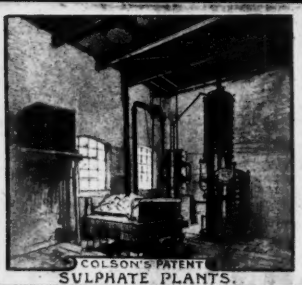

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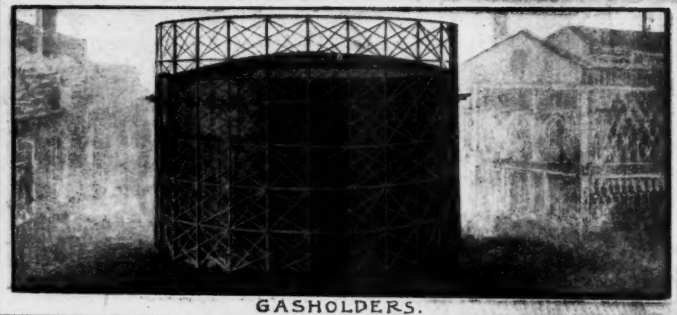

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£161 more. There were also some smaller items. Probably some of those present would remember that at the last meeting he had referred to the fact that the Board had felt it absolutely needful to replace the retort-settings, which had become quite out of date, by improved ones, with regenerative furnaces; and the Directors anticipated from such reconstruction considerable economy in fuel, and a saving in wear and tear which would soon repay the initial outlay, as well as increase the productive power. A considerable proportion of the expense involved in this important work had been charged under the head of "Repairs and maintenance of works." There had also been included in the expenditure the cost of a tar-extractor, a foul main, and the foundations for the new condensers and purifiers. With regard to the water department, the receipts from water-rates during the six months under review amounted to £17,366; and from rents and transfer fees, £80—making a total of £17,446, or £799 more than in the corresponding period of 1907. The water expenditure amounted to £7969, which showed a decrease of £176. The total profit on both the gas and water departments amounted to £12,544—that was, on gas, £2839; on water, £9477; and on fittings, £228. From this sum there had to be deducted £2289 for interest and income-tax, £1000 for transfer to the contingency fund in pursuance of the resolution passed six months ago, and £9434 the amount of the dividend as recommended in the report. Then they would require a small balance of £179 to be drawn from the accumulated fund which was brought forward from last year, and which amounted to £20,123; and this would leave for carrying forward to the new half year a balance of £19,944. During the past six months, the length of the gas-mains had been increased by 1467 yards, and of the water-mains by 1964 yards—making a total increase of 3431 yards. The amount of water pumped into the district was 337,388,000 gallons, which was an increase of 31,725,000 gallons as compared with the previous year. There were during the same period 141 new services for gas laid on, and 410 for water—making a total of 551 new services. It might perhaps be well to call the attention of the proprietors to the "Contingency account," which appeared in the present report for the first time. It would be observed that the Board had felt it right to charge against this account two considerable sums—the first being a proportion of the cost of constructing the new well at Northaw, and the second the cost of deepening the wells at New Barnet and of driving new adits, by which outlay, he was glad to say, a very satisfactory increased supply of water had been obtained. The Directors felt sure that, in taking this action, they might confidently rely upon the warm approval of the shareholders. It would doubtless have been noticed that there were two very important paragraphs in the report; and to these he desired to call special attention. The first related to the Engineer and Manager, Mr. Thomas H. Martin, who, after more than thirty-five years' continuous and efficient service, had felt it right to resign his office, the duties of which he had discharged with such ability. The Directors were confident that the shareholders would join with them in expressing the earnest hope that for a long time to come Mr. Martin might enjoy restful and pleasant relaxation. The second paragraph reported the action of the Board in appointing to the vacant office of Engineer and Manager Mr. Francis J. Bancroft, B.Sc., M.Inst.C.E., a gentleman who for more than twelve years past had had under his entire charge the Water and Gas Departments of the Hull Corporation, and who had most successfully carried out very important engineering works in that great commercial centre. The Board had the utmost confidence that the appointment of Mr. Bancroft would be of signal advantage to the prosperity and future progress of the Company.

Mr. A. F. PHILLIPS, in seconding the motion, remarked that, after the very full statement of the Chairman, nothing remained for him to say. The Directors had considered it wise to charge as much as they had done of the restoration of the retorts to revenue. It was a work which would, of course, last for many years, and very materially add to the efficiency of the gas undertaking.

The resolution was, without discussion, carried unanimously.

On the proposition of the CHAIRMAN, seconded by Mr. H. RAMSBOTTOM, dividends were declared for the half year, less income-tax, at the rates of 7½ per cent. per annum on the "A" and "C" stocks, 6½ per cent. per annum on the "B" stock; and 5¼ per cent. per annum on the "D" capital gas and water stocks.

Mr. ALFRED LASS, F.C.A., next proposed a vote of thanks to the staff. He said that their Engineer and Manager, with whom he had been associated during the whole of the period Mr. Martin had been connected with the Company, had done good service; and he was quite sure that, now the time had come for him to retire from active life, they would all wish him a quiet, peaceful, and happy eventide. In conjunction with Mr. Martin, he had also to associate the names of the Secretary (Mr. Drew), the Chief Accountant (Mr. Wright), and the staff generally. They as a Company had been blessed for many years with an excellent and efficient staff.

Mr. J. L. CHAPMAN seconded the motion, and it was carried.

Mr. C. A. BANNISTER remarked that there was a special event taking place in connection with the Company which he thought ought to be signalized a little more fully—he referred to the loss they were sustaining by the retirement of Mr. Martin. He (the speaker) was in the unfortunate position of being the last one remaining of those who were associated together at the inception of the Company; and as he had had the opportunity of estimating the qualities of Mr. Martin from the morning he entered upon his duties until the present time, he should like to say a word or two. He did not know whether it would be borne in mind, that when Mr. Martin was appointed, the gas-works of the Company were in a very disorganized condition. They had been let to, or had been occupied by, the Patent Gas Company—a patent which, to put it mildly, was not a success. Mr. Martin undertook, and carried out, the re-organization of the works; and he thought that from that day to this the works had never caused an hour's anxiety or worry to the Directors, but had been a source of continuous profit. There must be a recollection in the minds of the proprietors of the times of difficulty through which the Company passed with reference to the water undertaking; and he felt sure he was not going too far when he said that it was greatly owing to the skill, the resourceful energy, and the indomitable pluck of Mr. Martin that these difficulties were surmounted. He was not going to suggest to the meeting that Mr. Martin attained perfection as an Engineer or Manager—he did not suppose Mr. Martin himself would claim that; nor did he forget the labours of others, some of whom had passed away, while others remained, including their old friend Mr. Lass. But equally he did not forget that in the times of difficulty to which he had referred, the burden of bearing the private complaints and the public outcry, rested chiefly on Mr. Martin; and this burden he shouldered with an unflinching courage, a smiling face, and a cheering openness, which animated all those who served him. As the Chairman had remarked, there was in all their minds a common sentiment of regret that illness and advancing years had induced Mr. Martin to surrender his post; and they all hoped that the years which remained to him—which they trusted would be many—might be years of comfort and of that rest and repose which he had earned by his many and great services and his long-continued, arduous work. He would like, if it was not disapproved of, to move a special resolution—"That this meeting of shareholders expresses its grateful appreciation of the services of Mr. Martin during his whole period of thirty-five years' service, its regret that illness and advancing years have necessitated his retirement, and its hope that his future years may be those of happiness, comfort, and repose."

Mr. W. B. BRYAN seconded the proposal; remarking that he had known Mr. Martin for many years. He was aware of the great difficulties the Company had had to encounter in the past, and of how Mr. Martin did his best to overcome them. Personally, he felt very much obliged to Mr. Bannister for bringing the matter as he had done before the shareholders; and from his knowledge of Mr. Martin he could second the words that had fallen from him. He (the speaker) had also known the new Engineer for a great many years.

The resolution was heartily carried.

Mr. MARTIN said he thanked the speakers very much for their kind words, and the shareholders generally for the vote that had been passed. Of course, the years went by; and he felt the time had come when he should have a little repose. He did not like to sever his connection with the Company after so many years; but when one did not feel that he could do his work properly, it was time to give up and let someone else do it. He would endeavour, if called upon, to do what he could for the Company at any time—his services would always be at the disposal of the Company and of his friend Mr. Bancroft. He had known Mr. Bancroft for many years, and, in fact, introduced him into the gas and water business.

Mr. DREW and Mr. WRIGHT having returned thanks for the vote to the staff,

Mr. BANCROFT said he thanked the proprietors very much for the welcome they had given him that day as their Engineer and Manager. He was fully conscious of the trust the Directors had placed in him; and he would do his utmost to justify their confidence. He was no stranger to the Company or the district. He knew the possibilities of the area that was served; and it would be his endeavour that the Company should have an efficiently served body of consumers, and that the profit if possible should be increased, and that in every way the best interests of the Company should be promoted. He had also to thank Mr. Martin for his kind words; and he would like to be associated with the remarks that had fallen from Mr. Bannister and Mr. Bryan concerning that gentleman. He had served for more than ten years under Mr. Martin, whose every thought, he could say without the slightest reservation, was of the Company. Mr. Martin regarded the Company with great affection; and he hoped he would have good health, and enjoy his well-earned retirement for years to come.

On the motion of Mr. SAMUEL CUTLER, seconded by Mr. F. R. SMITH, a vote of thanks was accorded to the Board; and it was acknowledged by the CHAIRMAN.

Extraordinary Meeting.

An Extraordinary General Meeting was then held, at which

The CHAIRMAN moved a resolution authorizing the raising, by the creation and issue of new ordinary shares of £10 each (nominal value) or stock of the Company, a sum not exceeding in the whole £150,000 "D" water capital, as authorized by the Barnet District Gas and Water Act, 1904.

Mr. PHILLIPS seconded the motion, and it was carried.

This concluded the proceedings.

PROVINCIAL GAS COMPANIES.

Shareholders and Consumers Divide Profits at Harrogate.

At the recent half-yearly general meeting of the Harrogate Gas Company, the Chairman (Mr. F. Barber) expressed his regret at being unable to report the final completion of the railway, but was glad to be in a position to state that the work had been sufficiently advanced up to the 13th of July to enable the whole of the coal to be hauled from Bilton Siding, and that traffic had since that time been entirely removed from the highways. He mentioned the necessity of applying to Parliament in the forthcoming session for statutory authority in connection with land transactions with the Corporation, and for other powers necessary for the progressive management of the Company's business. In comparing the past half-year's working with that of the corresponding period of 1907, he explained that, having regard to all the circumstances, there had been a satisfactory extension of the Company's business, resulting in an increased output of gas. With the more hopeful prospects of a better coal market, the Board were not to be easily deterred in their policy of giving to the consumers a substantial share of the profits in the undertaking. They had determined to reduce the price of gas 2d. per 1000 cubic feet from the 1st of July last; and he thought it would be interesting to the proprietors to know that since 1901 the consumers had received, in reductions of price made since then up to the 1st of July last, no less than £29,000. As against this there had been distributed among the proprietors out of the increased profits of the undertaking during the same period the sum of only £1250, made up by an annual sum of £250 in each of the five years. The result of the further reduction now made was that the consumers would get the advantage of £8000 per annum on the price which prevailed in 1901.

This by no means represented the full benefit derived by consumers during this period. It was now a well-ascertained fact that those using inverted burners obtained eight times the lighting effect from every 1000 cubic feet of gas, compared with that previously obtained by the flat-flame burner; and there was still good hope for the consumer that by the use of high-pressure gas the value in light would be twenty times as much as that obtained from the open burner. The usual interim dividends were declared, and a vote of thanks to the Chairman and Directors closed the meeting.

Prospective Reduction in Price at Hastings.

In the report presented by the Directors of the Hastings and St. Leonards Gas Company at the half-yearly general meeting last Thursday, they stated that considerable progress had been made in clearing the site of the old works, and in removing the remainder of the plant to the new works at Glyne Gap. Contracts for the supply of coal, to follow those now running, had been made at some reduction on last year's prices; so that it was hoped to revert at no distant period to the old price of gas. The accounts accompanying the report showed that the revenue for the half year ending the 30th of June was £46,718, of which £35,025 was for gas and £8653 for residual products; while the expenditure amounted to £34,858, of which £20,681 was for coal, oil, &c. The balance carried to the profit and loss account was £11,859; and the Directors recommended the payment of the statutory sliding-scale dividends, less income-tax—viz., at the rates of £6 5s., £4 15s., and £5 17s. 6d. per cent. per annum respectively on the 5 and 3½ per per cent. converted and 5 per cent. additional stocks. In moving the adoption of the report, the Chairman (Dr. G. G. Gray, J.P.) said he thought the shareholders would agree with him that the past half year had been a very successful one, under all the circumstances, Taking the revenue account, they found that the sale of gas showed an increase of £1328. This was arrived at in the following way: The amount received for the sale of gas increased by £1613, of which £1539 was for private lighting and £74 for public lighting and contracts. But from this had to be deducted a decrease of £285 in the rental of meters and stoves. Then they must add to this an increase for residuals of £509, arising almost entirely from extra sales of coke. The total increase in the revenue was £1831. But there had been an additional expenditure to the extent of £977, which brought the £1831 down to £146. The balance (£11,859) was practically the same as that for the corresponding half of 1907. It was sufficient to pay the statutory dividends and leave a small sum to be carried forward. The increased expenditure was almost entirely caused by a rise of £1902 in the price of coal. To this had to be added £947 under the head of repairs. During the past half year they had had to remove their oil-gas plant to the new works at Glyne Gap. There was an additional expenditure of £2988. From this there were various items showing a decrease of £1011 which had to be deducted—leaving an increase in expenditure of £1977 for the half year. On the previous occasion he had gone fully into the reason for raising the price of gas; the principal one being the advance in the price of coal, coming, as it did, so shortly after the great expenditure incurred on their new works, and at a time of local depression. They had been able now to enter into fresh contracts for coal; and, as stated in the report, the Board hoped to revert to the old price at the earliest possible opportunity. Mr. Idenden seconded the motion; and it was carried unanimously. The retiring Directors and Auditor having been re-elected, Major Stanley Weston, J.P. (one of the former, and a member of the Town Council), in returning thanks, referred to the competition the Company had from the Corporation's electric light works, and said he thought the shareholders could congratulate themselves on the fact that they had been able to hold their own against it.

Continued Growth and Prosperity at Ilford.

The ordinary half-yearly general meeting of the Ilford Gas Company was held at the offices and show-rooms last Tuesday, under the presidency of Mr. W. Ashmole, the Chairman. The report and accounts for the six months ending the 30th of June were presented; and the Directors recommended the declaration of dividends for the half year at the rates of 6½ per cent. per annum on the "A" and "C" stocks, and 5 per cent. per annum on the "B" stock (less income-tax), and the carrying of £786 to the reserve fund. In moving the adoption of the report, the Chairman said the accounts submitted to the proprietors showed the continued growth and prosperity of the Company. The plant had been kept in thorough order, and the Directors were completing the resetting of four beds of retorts to be ready for the winter's work. With regard to the business in the outdoor department, fresh consumers were being added to the Company's books daily. The competition of the electric light was not now making itself felt to the same extent as in previous years. At one time it was a novelty; and naturally a large number of people had it installed in their houses and shops. The novelty had, however, worn off, and people were beginning to realize that their particular business benefited by the cheaper and more reliable light. As a matter of fact, the Company were not only able to keep most of their old customers and make new ones, but had displaced electric light in a considerable number of shops and houses; the parties in every case where this had occurred being more than pleased at the decided improvement, not only in the lighting, but also in the substantial saving in cost. Turning to the accounts, he thought a few remarks on the principal items might be of interest. Taking the revenue account, it would be noticed that the balance carried to the profit and loss account was £7828, against £9157 for the first six months of last year, or a decrease of £1328. This, however, was more than accounted for by the enhanced cost of coal; the difference in price being equal to £1949. On looking over the reports and balance-sheets of a number of companies, both in the provinces and in their own immediate neighbourhood, he found that in practically every instance there had been a great increase in this particular item—showing that the rise in the price of this most essential article did not affect their own Company only, but was general throughout the country. On looking at the credit side of the account, it would be seen that the revenue from the sale of gas had increased by £1564; and the rental of stoves, fires, &c., by £345. The residual products, however, showed a decrease to the extent of £320. With regard to the manufacture and sale of gas, the increase in these two items was still maintained, and must be most gratifying alike to the stockholders, officials, and staff. The quantity of gas manufactured for the past half year was 180,708,000 cubic feet, against 168,172,000 cubic feet for the corresponding period of 1907; being an increase of 12,536,000 cubic feet, or equivalent to 7·45 per cent. The sale of gas for the same two periods was 167,072,000 cubic feet and 156,223,000 cubic feet respectively, which was equal to an increase of 10,849,000 cubic feet, or equal to 6·94 per cent. When it was remembered that Ilford, along with other suburban districts, had been to a certain extent at a standstill with regard to new buildings, it was certainly pleasing to be able to report this substantial increase. The following figures would, he had no doubt, be interesting to the stockholders, as showing how the Company had grown during the past years. In 1900 the annual make of gas was approximately 127 millions; in 1902 it was 179 millions; this year it was 362 millions. In other words, the make of gas was practically double what it was six years ago, and treble what it was eight years ago. This was a very remarkable growth, and one which he was sure would be hard to beat. The total number of meters in the Company's district was 12,258, and of gas-cookers on hire 8667. The Company had also fires on hire, and had sold a considerable number of cookers, fires, &c. They were now offering every inducement to the consumers to purchase these articles by having them on the hire-purchase system. Taking the position of the Company generally, the Board had every confidence in its future prosperity, knowing, as they did, the healthy and sound condition it occupied at the present time. In conclusion, he expressed the wish of the Directors (which he was sure would be endorsed by the stockholders present) that the Company would grow and prosper in the future as it had done in the past. The report and accounts were adopted; and the dividends recommended were declared. Votes of thanks to the Directors, officers, and staff concluded the meeting.

Improved Plant and Good Working at Littleborough.

In the absence of the Chairman (Mr. Alfred Law, J.P.), Mr. J. C. Hudson presided at the half-yearly meeting of the Littleborough Gas Company. The Directors in their report recommended the declaration of the maximum dividend at the rate of 10 per cent. per annum (less income-tax). The Chairman, in moving its adoption, said it was gratifying to again report a further increase in the sale of gas, which realized £4442, compared with £4298 last year; the actual consumption being 30 million cubic feet, which represented a 3½ per cent. increase. Residuals produced £1291, against £1109; but coal cost £1859, against £1667. The profit on the revenue account was £1427, and the disposable balance, subject to the half-year's dividend, was £2733. The reconstruction of the retort-house had been completed during the half year, and the whole of the direct-fired settings had now been abolished; the new regenerative bench providing about 35 per cent. margin over the maximum requirements. The working results for the twelve months ending the 30th of June showed that 6031 tons of coal were carbonized, producing 65,448,300 cubic feet of gas, averaging 10,851 cubic feet per ton; the coke available for actual sale being 10·8 cwt. per ton of coal. The Company have now 1500 cookers in the district; and the slot-meter consumption showed a 20 per cent. increase for the half year. Satisfaction was expressed by the shareholders at the position of the Company. The report was adopted; and thanks were accorded to the Directors, the Manager and Secretary (Mr. S. E. Halliwell), and the officials. By the invitation of the Chairman, the shareholders at the close of the meeting inspected the works and plant, under the guidance of the Manager.

Good Increase at Melton Mowbray.

The annual meeting of the Melton Mowbray Gas Company was held on the 28th ult., when a satisfactory balance-sheet was presented. The sales of gas had increased by 2½ million cubic feet; and though coals had cost more than before, the price of gas had not been raised, and it was the hope of the Directors that very soon they would be able to reduce it. The profit for the year amounted to £1870. The usual dividend of 7½ per cent. was declared; the Directors placed £100 to the reserve fund, and carried forward a good balance. Great satisfaction was expressed at the result of the year's working; and votes of thanks were accorded to the Chairman and Directors.

Satisfactory Half Year at Richmond.

The report presented by the Directors of the Richmond Gas Company at the recent half-yearly general meeting contained a recommendation that a dividend at the rate of 5¼ per cent. per annum on the consolidated ordinary stock should be declared. In moving its adoption, the Chairman (Mr. T. J. Carless), referring to the accounts for the six months ending the 30th of June, said the most notable items in the revenue account were the extra cost of coals and the increased receipts for residuals. As the proprietors were aware, coal advanced in price to so serious an extent last year, that had the Directors not seen something of the kind coming and bought forward, they would certainly have had to raise the price of gas or suffer a considerable drop in the profits. As it was, however, they had managed to get through without increasing their charge, which was a cause of great satisfaction to them and a considerable benefit to the consumers. During the half year, coal had cost upwards of £1600 more; and he was afraid they must not expect much relief during the coming twelve months, for though they had been enabled to make their new contracts at a considerable reduction on those concluded in 1907, the average would work out to about the same figure as that included in the present accounts—the earlier contracts at a lower price having run out. The other items making up the revenue account were normal; and the gross profit was within £10 of that made in the corresponding period of last year. The works and distributing plant had been maintained in first-rate order, and there had been no complaint of want of pressure in any part of the district. On the other side of the revenue account, they had to record an increase in the amount received for gas, public lighting, rental of meters, stoves, and maintenance of incandescent burners. Coke had brought in close upon £900 more, owing to better prices ruling in sympathy with the advanced charges for coal. Sulphate, too, had figured out better; upwards of £1300 having been received, against £1000 last year—both the price and working being better. Consequently, residuals had come to the rescue, and helped the Directors to meet the increased charges for

coal. By the profit and loss account it would be seen that they had made their dividend and a little to spare; and they had now to carry forward close upon £3000. This, added to the reserve and insurance funds, gave a total of about £14,000 of undivided profits, and placed the Company in a strong financial position, practically assuring shareholders their dividends in the immediate future, and enhancing the value of their holdings. He did not think he need do more than congratulate them and the Directors on the result of the past half-year's working, which was a credit to all concerned. Before sittting down, he would take the opportunity of mentioning that under the Richmond Gas Act, 1901, they had entered into an arrangement with the Town Council, whereby the testing of the gas had been brought up to date, which they trusted would remove all cause of friction, and bring the Council's and the Company's testing returns into harmony. Mr. Chancellor seconded the motion, and it was carried without remark. A vote of thanks having been accorded to the Directors, a similar compliment was paid to the Engineer and Secretary (Mr. Thomas May) and his staff. Mr. May, in responding, acknowledged the kindness of the Directors, and said the staff much valued the appreciation shown of their work.

Profit Sharing at Rugby.

The report of the Directors which was submitted at the half-yearly meeting of the Rugby Gas Company on Monday of last week, stated that the mains had, by request, been extended to the village of Dunchurch. The receipts for the past six months amounted to £11,683, and the expenditure to £9014; leaving a balance of £2669 to be carried to the profit and loss account. A dividend was declared at the rate of 14 per cent. on the original share capital, and 11 per cent. on the additional capital issued. The Directors reported that, in order to give the whole of the employees of the Company a direct interest in its success, they had formulated a scheme of co-partnership consisting of a sliding-scale bonus based on the price of gas—the bonus to accumulate and be ultimately invested in the Company's shares. The report was unanimously adopted.

Satisfactory Progress at Shrewsbury.

Gratifying statements as to the position of the Shrewsbury Gas Company were made at the annual meeting of the proprietors, held last Tuesday morning, under the presidency of Mr. T. Frank Poole, the Deputy-Chairman of the Company. In their report, the Directors stated that the profit on the working for the year ending the 30th of June amounted to £8164. An interim dividend of 2½ per cent. was paid in March last, and the Directors recommended that a final dividend of 3 per cent. (making 5½ per cent. for the year) should be declared; leaving a balance of £2350 on the profit and loss account. The reserve fund amounted to £10,671, and was fully invested. There had been an increase of more than 2 million cubic feet in the consumption of gas during the year. The stoves on hire at June 30 numbered 2705; and there were 3243 prepayment meters in use. The Deputy-Chairman, having referred to the satisfactory nature of the report, said he was desired by the Chairman (Mr. J. Spencer Phillips) to apologize to them for his absence. He then went on to read some observations prepared by Mr. Phillips on the report. He said it was one which he thought they would regard as satisfactory, considering the adverse conditions under which they had had to work during the period under review. The volume of business showed continuous progress all round. They had made 2,598,000 cubic feet, or 1·32 per cent., and had sold 2,161,000 cubic feet, or 1·19 per cent., more gas. Their receipts for gas sold amounted to nearly £300 more, and they had had increased returns from their sale of coke and breeze—just over £1000—which was some set-off to the greater cost of coal. They had also made £321 from the sale of ammonia. On the other hand, they had had to pay no less than £2594 more for their coal; and their wages had increased by £217. Notwithstanding this heavy increase in the cost of coal, which was the straw with which they made their bricks, by due economies and watchfulness over every item of their expenditure—economy which he must clearly state had not been carried out at the cost of efficiency—they had not been compelled to raise the price of gas or to reduce the rate of dividend. For this they wished to give all credit to their Secretary and Manager (Mr. William Belton) and the other officials who carried out his instructions. The Board directed the general policy of the undertaking; but details of this description depended on the close and careful supervision of their officials. The shareholders would, he was sure, notice with satisfaction that there was an increase of 142 stoves on hire and 113 slot-meters in use; the total reaching the very respectable number of 2705 and 3243 respectively. The public were appreciating more the great economy and cleanliness of gas-stoves for cooking and heating purposes; and the small consumers were daily becoming more alive to the advantages they derived from the system of prepayment meters introduced some eleven years ago. There had been an addition of £3000 to the capital during the past year. This was disposed of by tender at an average price of £127 per £100—a fairly strong testimony to the high estimate which the public had of the Company's stock. He was glad to say they had obtained some reduction in their coal contracts for the current year, though the coal owners continued to exact a price which he hardly thought the home demand for the commodity justified; and he also thought, for many reasons, the abrogation of the tax of 1s. per ton on exported coal was one to be regretted. The Deputy-Chairman then moved the adoption of the report, and the motion was carried. The dividend recommended having been declared, and the retiring Directors and Auditor re-elected, a vote of thanks was accorded to the Chairman and Directors for the care and attention they had bestowed upon the affairs of the Company. The Deputy-Chairman acknowledged the vote, and moved a vote of thanks to Mr. Belton and the other officials for their services. In doing so, he said no words were needed to commend the work of their excellent Manager. They were indebted to him and to the other officials for the ability with which they carried out the instructions of the Board. They had a very loyal staff of officials. The motion having been carried, Mr. Belton, in reply, said it was a pleasure to serve a Board of Directors who were not only good business men, and understood what they were doing, but who took a real and deep interest in the working of the concern, and made themselves acquainted with everything connected with it. A vote of thanks to the Auditors afforded Mr. Adams (one of them) an opportunity of speaking in high terms of the manner in which the accounts were kept.

A Big Increase at Southend.

The report submitted at the half-yearly meeting of the Southend Gas Company last Tuesday stated that during the six months to June 30 145,737,100 cubic feet of gas had been sold, being an increase over the corresponding period of the previous year of 11·61 per cent. The total number of consumers was 11,589, of which 7729 were automatic. The profit and loss account showed a balance of £9306 (including £2743 brought from the last account) available for dividend; and the Directors recommended the payment of dividends at the rate of 5¾ per cent. per annum on the original consolidated and new ordinary stocks, and 5⅜ per cent. per annum on the new ordinary "B" stock, less income-tax, together amounting to £6473, and leaving £2833 to be carried forward. The report of the Engineer (Mr. Francis Clark) stated that contracts had been entered into for the extension of the retort-house and for the machinery to be placed therein. The Chairman (Mr. C. F. Woosnam) explained that the retort-house extension was well in hand; and the Directors hoped to be at work there early next year. The Board were some time before they were satisfied with regard to the best and most up-to-date method of carbonizing; but, after visiting many works, both in this country and abroad, they believed they had selected the best and most improved plant, and expected to have better results than they were getting now, though their make at the present time for coal was good—viz., 10,749 cubic feet per ton. The Company were still paying a high price for their coal—1s. 6d. per ton more than in the corresponding half of last year—and they had done well to earn their dividend, which they were not always sure of doing in the first half of the year. The report was adopted; and the remuneration of the Directors, on the proposition of Mr. Bosher (a shareholder), was increased from £500 to £800 a year.

GAS PROFITS AT STOCKPORT.

The Chairman of the Stockport Gas Committee (Mr. James Fernley), in moving, at the meeting of the Town Council last week, the adoption of the report of the Engineer (Mr. S. Meunier) for the year ending March 31 last, said that it furnished a record of the most satisfactory results ever produced by the gas undertaking. During the last two years, the profits had been nearly double what they were three years ago. For the year ended March, 1906, the net profit was £10,158; for 1907, it was £17,412; and for 1908, it was £19,071. The gross profit for the year under review was equal to 14·647 per cent. on the outstanding capital. The net profit, after paying £8103 for interest, and £9886 to sinking fund and stock redemption fund, was £19,071, of which £15,000 went in aid of the rates, and £4071 to the reserve fund. The quantity of coal carbonized was 56,034 tons; the gas made being 803,492,000 cubic feet, of which 747,660,600 cubic feet had been sold, and 47,062,000 cubic feet had disappeared. This leakage, however, was not serious. The works had been maintained in a satisfactory manner. The Engineer reported favourably of the new inclined retorts, which the members of the Council had an opportunity of seeing twelve months ago, when they visited the works; and it appeared that the expenditure of some £25,000 on this plant was a wise one from the ratepayers' point of view. This undertaking, in which the ratepayers had a large sum at stake, was a most valuable asset, and one from which they rightly looked for good profits to relieve the rates. He (the Chairman) was very pleased that the past year had proved so satisfactory, as with the extra cost of coal (£2769) and the advanced price of all stores, he was afraid lest they might fall below the previous year. However, with watching every point, satisfactory management, and the unanimous support of the Committee, the results of the year's work were very satisfactory.

Alderman Green (the Vice-Chairman of the Committee) seconded the adoption of the report, which was carried unanimously.

Scunthorpe Gas-Works Accounts.—The abstract of accounts of the Scunthorpe Urban District Council gas undertaking for the past financial year shows a total income of £4987, while the expenses have been £2876; leaving a profit of £2111. A sum of £1773 has been spent in interest and repayment of loans, depreciation, &c.; and adding the amount brought forward from the previous year (£1402), a balance is left of £1740. The year's sale of gas was 24,372,300 cubic feet.

Ottoman Gas Company.—The report of the Directors to be submitted at the meeting next Tuesday states that the gas-rental for the half year to June 30 amounted to £15,232; while for the corresponding half year it was £14,802. The net profit is £3755, as against £3187 for the six months ended June 30, 1907. The amount standing at the credit of profit and loss account is £12,825. The Directors recommend the payment of a dividend at the rate of 7 per cent. per annum on the preference shares, less income-tax, and at the rate of 8 per cent. per annum on the ordinary shares, tax free—leaving a balance of £9927.

Gosport Water Company.—The half-yearly meeting of the Gosport Water Company, held last Wednesday, was presided over by the Chairman of the Board, Mr. William E. Churcher. The report showed that the revenue for the half year to June 30 was £4489, and the expenditure £1882; allowing £2607 to be transferred to the profit and loss account. After providing for all liabilities, the total of this account was £7027. The new services connected with the Company's mains were 44, bringing an increase of £153 in rentals. As the Soberton supply had been completed, the fresh areas were proving an increased source of revenue; while the Admiralty's approval had been shown by again taking the water for many of the ships of the Royal Navy. The cost of the Soberton works had been well within the estimate, which would avoid the necessity for the raising of any fresh capital. Dividends were declared at the rates of 4½ and 5 per cent. on the preference stock, 5 per cent. on the consolidated ordinary stock, and 3½ per cent. on the ordinary stocks of 1883 and 1887.

OLDBURY GAS SUPPLY.

Reduction in Price.

At the Meeting of the Oldbury Urban District Council last Friday, the Gas Committee recommended that after the next quarterly reading of the meters the price of gas per 1000 cubic feet should be as follows: Under 25,000 cubic feet per quarter in one building, 2s. 8d.; 25,000 to 100,000 cubic feet, 2s. 6d.; 100,000 cubic feet and upwards, 2s. 4d.; gas for cooking purposes, 2s. 4d.; gas for motive power, 1s. 5d.—all subject to the usual 5 per cent. discount as at present.

The Chairman (Mr. C. Thomlinson), in moving the adoption of the report, referred to the proposed concessions, and said the Committee had been able to take this action owing to the reduction in the cost of coal on the present contract. Mr. Jeffries asked whether the cost of the gas used for motive power exceeded the charges made when they considered the proper proportion of establishment charges. It seemed to him that gas for motive power ought to be sold at cost price *plus* the proper proportion of the establishment charges, and those who used motive power ought not to get it at less than this price. He asked whether the charge of 1s. 5d. was reckoned on this basis. Mr. Wilson said the policy of the Committee and of most other gas committees throughout the country was to see if they could find a day load, which went on when the ordinary night load was not on, and paid the undertaking even if it only kept their plant going. In this way it paid them to take a price which was ample to cover the cost of raw materials, purifying materials, cost of labour, and all the extras involved in making the gas; but they did not pretend to cover the cost of paying interest or the instalment of the sinking fund. They could take the manufacturing cost of gas as two-thirds the total cost. By putting the price of gas for motive power at this figure, the Gas Committee obtained orders they would not otherwise get. Mr. Davies said the price was too high, and they had to take into consideration the competition of electricity. Mr. Jeffries also expressed the opinion that large consumers of gas for lighting purposes should have some consideration. The Chairman said the whole question was one of keeping a day load, as Mr. Wilson had explained very well, and as was understood by a business man. They had to employ the same staff at the works; and if they did not keep the plant fully engaged by having a large consumption of gas for motive power, they would be the losers on the cost of the works, especially the retorts. As far as the consumers of gas for lighting purposes were concerned, he thought the small ones should be considered as well as the large ones. After some further discussion, Mr. Wallace moved that the price of gas for motive power should be 1s. 6d. per 1000 cubic feet, and the charge to consumers of more than 100,000 cubic feet should be reduced 1d. The proposition was seconded by Mr. Jeffries; but only he and the mover supported it. Mr. Wallace then proposed an amendment in favour of a scale such as the one in force at Smethwick; but this was also defeated.

The report of the Committee was then adopted.

GAS SUPPLY OF BIRKDALE.

Another Grumble.

A lengthy correspondence between their Clerk (Mr. J. F. Keeley) and the Town Clerk of Southport (Mr. J. E. Jarratt) has been laid before the Birkdale Urban District Council, who have agreed that unless the cause of complaint is removed an appeal shall be made to the Board of Trade for protection.

The matter was opened by Mr. Keeley, who, on July 22, wrote to Mr. Jarratt calling attention to the fact that the Southport Gas Committee's employees had been using a powerful force pump for clearing deposit which had accumulated in certain gas service-pipes in the district, and had forced the deposit into his Council's gas-mains. He added: "My Committee desire me to point out that by this unfair treatment gas-mains of a diameter of 3 or 4 inches will soon be completely choked, and it will be impossible (through the action of your Corporation's servants) for my Council to distribute the gas through the Birkdale mains at a reasonable pressure, if this practice is continued." In a further letter, Mr. Keeley stated that the amount of deposit taken from a ¾-inch gas service-pipe 36 feet in length, on June 30 last, weighed 1½ lbs. On July 30, Mr. Jarratt asked for some more information, and said that, as then advised, there was no justification whatever for the general complaint that had been made. Mr. Keeley's answer to this was that the Corporation employees had admitted to him that they had used the force-pump in the district. In answer to this, Mr. Jarratt said the force-pump had been used on two occasions; and he asked permission to open up the road and examine the main, so as to ascertain whether there was anything at all in the complaint. He continued: "I may say that, though Mr. Bond (the Gas Engineer) still thinks that the use of the force-pump was and is justified, as a matter of fact it has not been used since the date he received your first communication on the subject. The deposit to which you have referred in your correspondence it now appears was not taken from a place where we have used the force-pump. Moreover, Mr. Bond informs me the deposit was of such a nature as could not possibly have been forced into your mains. In the two cases where it was used, the force-pump was entirely ineffective. The services had to be taken up; and they were found to be nearly rusted-up." Answering this letter, Mr. Keeley said he was informed that the force-pump had been used in other than the two places admitted by the Town Clerk of Southport, and, not only had this been done, but water had been poured down the service-pipes. He went on to remark: "Your Gas Engineer informed me that he had given instructions for the force-pump not to be used in my Council's district. Therefore it is evident his orders have been disobeyed; and it is to prevent a recurrence of this unfair treatment that I am compelled to ask you for an undertaking that this questionable method of clearing service-pipes in the urban district of Birkdale, to the detriment of my Council, be discontinued. The deposit weighing 1½ lbs. was taken from the gas service-pipe, and not from the main; and the deposit was of such a nature that if the force-pump had been used in this case a large quantity would, beyond doubt, have been forced into the main." At this stage the correspondence remained when it was submitted to the Council, with the result already recorded.

OSWALDTWISTLE GAS-WORKS EXTENSIONS.

Local Government Board Inquiry.

An inquiry was recently held by Mr. E. A. Sandford Fawcett, on behalf of the Local Government Board, into an application by the Oswaldtwistle Urban District Council to borrow sums of money for various purposse—among them being the carrying out of certain extensions of the gas-works.

The Clerk (Mr. B. T. Westwell) explained that the gas-works were erected in 1869 under a Special Act giving them borrowing powers to the amount of £20,000. Several Provisional Orders had since been obtained; the latest one being in 1898. Altogether for gas-works and the erection of the Town Hall the Council had obtained powers to borrow £50,000. Of this amount, £41,502 had been expended on the gas-works, and £5939 on public buildings; leaving the margin of borrowing powers £2559. They wished to have power by Provisional Order to borrow a further £20,000.

The Gas Manager (Mr. J. H. Davies) furnished particulars of the scheme the Council had in hand. The full scheme, he said, included six regenerator settings. The Council were now engaged in completing three of the settings, so as to increase the producing capacity to meet the demand during the ensuing winter. They might perhaps be required to put another down; and, if so, he calculated it would carry them over two more winters. The Council might also decide to go in for slot-meter and cooker installations, fixing the pipes in houses where there was no supply. The carrying out of any future works of extension would be subject to sanction by the Local Government Board. The average annual profit from the gas-works was £1000. The present application was in respect of £150 for the purchase of land required for the purpose of gasholder extensions at some future time, and the erection of three regenerator settings. Last year they were unable to supply all the gas needed, because they could not make it; and they had to reduce the pressure on the mains. Thus far about £1800 had been expended on the works, which they were compelled to commence so that they could be completed before the winter.

Mr. James Grimshaw, a former member of the Council, pointed out that the gas-works were situated in Church, and they were subject to a rate of about £200 per annum to Church, varying according to assessment. For years complaints had been made by the residents and officials of Church about an undue escape of gas and extremely noxious and highly objectionable fumes from the gas-works. The works were situated 20 feet below the street level, necessitating needless team labour; and the street approaches were narrow and dangerous. The site was in a very cramped position, making it altogether unsuitable for extensions and modern improvements. Though the railway passed close by, they could not avail themselves of it by having a siding for coal, which had to be brought by team labour at great expense. The works were old, dilapidated, and worn out. In support of this, he quoted from a minute of the Gas-Works Committee, passed on Jan. 27, stating that the Gas Manager submitted plans for the enlargement and improvement of the works as follows: For the provision of new mains, retort-house extensions, six benches of regenerator settings, exhausters, condensers, governors, washer-scrubbers, with pumps, purifiers, conversion of gas-tank to tar and liquor well, one gasholder, extension of mains, slot-meter and cooker installations, and contingencies, at a total cost of £15,000. He was afraid that the whole of the work the Council intended to do at the gas-works had not been indicated. It was the duty of the Council to relieve themselves of the burden of the £200 rate, and make use of land belonging to the Council at the sewage works for gas-works, where they could have a railway siding and canal siding. Though it might entail some little inconvenience, it would amply repay them to remove by instalments. He objected to the spending of thousands of pounds on the gas-works on the present site.

The Inspector, however, by inquiry, elicited that the Council were occupying all the land they owned at the sewage works.

Councillor A. Hargreaves said that the Council were fully aware that the works were in Church; and they would have been pleased if they had been somewhere else. But the cost of removal to another site would not be less than £36,000; and the township was not in a position to do any such thing. He refuted the statement concerning wholesale complaints against the gas-works, and said that during four years there had been one only; and that occurred during the course of the alterations now in progress. The sum of £20,000 would more than cover the whole scheme of extension recommended by the Gas Manager and adopted by the Council. With regard to the land at the sewage works, they had none which would not be utilized after the alterations which had been proposed. They would have to buy a site; and the cost would be enormous, because of the fact that carts thereto would have to go under the Leeds and Liverpool Canal. Mr. Grimshaw's project could not be carried out for less than £40,000 or £50,000.

This terminated the proceedings, which had also included an inquiry into an application for power to borrow £4010 for purposes of water supply.

Export of Monazite Sand from Bahia.—According to the last annual British Consular report on the trade of Bahia, 1741 tons of monazite sand were exported from the city during the twelve months ending Dec. 31, 1907, all of which went to Germany, as had been the case during preceding years. The quantity of monazite sand exported annually from the Bahia district during the past five years has been as follows: 1862 metric tons in 1903, 2901 in 1904, 1039 in 1905, 945 in 1906, and 1741 in 1907.

PUBLIC LIGHTING OF TONBRIDGE.

Municipal Electricity Again.

An example of how the attempt to obtain business for a municipal electricity undertaking may operate against the interests of the ratepayers is given in the "Kent and Sussex Courier." The tale has been heard before in other places; but notwithstanding this, the article is of sufficient interest to reproduce. It is as follows.

Recent correspondence between the Tonbridge Gas Company and the Urban District Council with regard to the cheapest form of street lighting, furnishes another illustration of how municipal trading, pushed to illogical extremes, operates to the positive loss and disadvantage of the ratepayer, and defeats the very end which municipal enterprise is supposed to serve. In this case, the question at issue is whether a local authority are justified in charging the ratepayers a higher price than a competitive contractor is prepared to do the work for, simply because the local authority have set up as traders, against their own ratepayers, and are in a position to reject any tender at a lower price than that which the local authority choose to exact from the ratepayer. The net benefit to the municipal undertaking in these circumstances must be small compared with the loss to the general body of ratepayers; and the argument that the ratepayers are supporting their own undertaking by paying more than they need do, falls to the ground in the light of the recent criticism by the Local Government Board Inspector of the financial methods of municipal trading, which give little prospect of the ratepayers ever benefiting financially from what are euphemistically called their own undertakings. [See "JOURNAL" for July 28, p. 269.]

The facts at Tonbridge are as follows: At present the Tonbridge electricity undertaking is supplying 18 arc lamps at a total cost of £365 per annum. In competition with this rate, the Tonbridge Gas Company offered to erect, light, and extinguish in the Tonbridge High Street, 24 Keith high-pressure gas-lamps of a candle power the same as, or greater than, the electric arc lamps, at £10 per lamp as against £18, or £240 per annum as against £365. This offer was rejected; but, nothing daunted, the Tonbridge Gas Company offered still more advantageous terms to the ratepayers—viz, 24 high-pressure gas-lamps of 750-candle power for £190 per annum, as against the £365 per annum which the Council take from the ratepayers. There was a further offer to double the illumination, and give 24 gas-lamps of no less than 1500-candle power, which is about double the illumination of the arc lamps, and possesses greater diffusing power in foggy weather—the charge in this case to be £240 per annum, against £365 by the Tonbridge Council for half the illumination. These offers, notwithstanding their great advantages to the ratepayers, were rejected. The fact is of interest to Tunbridge Wells, as at present Tonbridge traders have the advantage over Tunbridge Wells tradesmen, with the exception of one or two instances, in being able to illuminate their establishments with high-pressure gas, the superiority and cheapness of which is shown by the above tenders. High-pressure gas lighting, thanks to the enterprise of the Gas Company, is becoming general at Tonbridge; and it is a significant fact that, while Tonbridge traders are availing themselves of the great economic advantages to be derived from high-pressure gas, the Tonbridge ratepayers have these advantages withheld from them—just the same as in Tunbridge Wells the ratepayers are made to pay a much larger sum annually for street lighting than they need do, if prices were regulated by open competition.

On the other hand, the electrical undertakings afford no relief to the rates, but are an increased liability to the ratepayers of both towns, owing to new loans being applied for. At Tonbridge, the Local Government Board appear to have been more vigilant than was the case at the inquiry at Tunbridge Wells, where the Council's application went through without any of the serious criticism that was directed against the policy of the Tonbridge Council by the Local Government Board Inspector. The fact remains that we have here a striking example of how municipal trading involves the ratepayers in direct loss by the indirect methods open to a local authority of subsidizing a municipal undertaking at the expense of the ratepayers by entering into extravagant contracts from which all commercial competition is carefully excluded. The percentage of public to private lighting being very high in municipal electricity undertakings, the Council yield to the temptation to manufacture revenue out of the ratepayers' pockets, instead of depending for more legitimate profits upon revenue from the private consumer, who, in the case of the gas companies, forms the major portion of their income.

GAS v. ELECTRICITY FOR ASYLUM LIGHTING.

Gas Adopted for the Cornwall Asylum.

Some months ago, the Visiting Committee of the Cornwall Lunatic Asylum had under consideration the question of the better lighting of the old part of the institution. A recent addition to the establishment is lighted by electricity; and it was suggested that the whole of the buildings should be similarly dealt with. Objection was taken to this on the ground of economy; and the result was that the matter was referred to the Finance Committee for further consideration. Last Tuesday, the subject again came before the first-named Committee in the form of a report by the Finance Committee, who recommended that the old part of the Asylum should be lighted with gas on the incandescent system, according to a specification submitted by the Bodmin Gas Company. The report stated that to wire the building and provide accumulators, &c., for an installation of the electric light would cost about £3000.

Mr. H. HODGE, in moving the adoption of the report, said that when he brought the matter forward about six months ago, his idea was that they could utilize the existing electrical plant, and by lighting the whole of the buildings on the same system save probably £200 or £300 a year. At his suggestion, the Electrical Engineer presented a report, which showed that they had sufficient plant to provide for the lighting of about two-thirds of the building in addition to what was being done in the new portion of the house. It was then decided to obtain a report as to the initial cost of wiring the building; and at the same time the Gas Company were asked to give an estimate of the cost of lighting it on the incandescent system. Their Manager (Mr. R. Greenaway) reported that there were 194 incandescent gas-burners already in use in the whole of the old buildings, and 595 flat-flame burners, which were obsolete, and ought to be replaced by incandescent burners, by doing which the light would be greatly improved and the cost diminished. They had been paying about £700 a year for lighting the old building, and by the proposed improvements they would economize to the extent of something like £311 per annum. This would be a saving to the ratepayers, while they would have about 50 per cent. more light in the wards. The Committee therefore recommended the adoption of the Gas Company's proposals, which they believed to be in the interests of the institution and the county generally. Had the incandescent system of lighting been adopted twenty years ago, it would have been greatly to the benefit of those living in the Asylum; while the ratepayers would have saved about £4000. The initial cost, in new burners, &c., would be from £80 to £100.

The CHAIRMAN (Mr. H. D. Foster) thought that, while there would undoubtedly be economy, they could not expect to save £300 a year in the cost of lighting. As to what might have been done in the past, it must be remembered that mantles were formerly much dearer than at present; and if they had had to pay 2s. 6d. each for every mantle used in an institution like the Asylum, it would have been a very costly item. From time to time the Committee had put in a number of incandescent burners.

Mr. R. FOSTER said no suggestion had been made in the past that they should adopt the course now recommended; and the Visiting Committee were not to blame, as Mr. Hodge seemed to suppose, if the lighting had cost more than it might cost now. Another system of lighting might be invented in the course of the next fifteen years.

Mr. HODGE said that if there was an improved method invented, the Committee would adopt it. It was their duty to get the best and cheapest article; and it was the business of persons outside to offer it.

The report of the Finance Committee was adopted.

The Fulbourn Asylum Lighting Question.

At the Monthly Meeting of the Fulbourn (Cambridge) Asylum Visitors on Monday last week, the question of the lighting of the Asylum, to which reference has already been made in the "JOURNAL" (see *ante*, pp. 304, 344, 404), was again under consideration.

The Clerk (Mr. F. M. Francis) read a letter from Mr. A. E. King, the Secretary of the Cambridge Gas Company, protesting against a paragraph in the Visitors' report on the subject of the lighting, in which it was stated that, in the opinion of Mr. Graham Harris (their electrical adviser), 12,000 units of electricity would be more than equal, in point of light, to 3 million cubic feet of gas, and stating that the Directors could not find any authority in Mr. Graham Harris's report which justified the statement attributed to him. He said it was obvious that the comparison was based on gas consumed with argand burners, and had perhaps inadvertently crept into the report without any allusion being made to this now almost obsolete mode of using gas for lighting purposes. He pointed out that it was manifestly unfair to the Company not to give the figures for gas consumed with incandescent burners, which were already extensively in use in the Asylum. He was therefore instructed to lay before the Visitors the following comparison in point of light obtained by the consumption of 3 million cubic feet of gas by incandescent burners, and 12,000 units of electricity, worked out in candle-hours:—

Candle-hours, obtained for 3 million cubic feet of gas, taking the low efficiency of 15 candles per foot per hour.	45,000,000
Candle-hours obtained for 12,000 units of electricity . .	9,600,000
Difference.	35,400,000

The amount of electricity, therefore, required to supply the difference would be 35,400 units, which, at 1½d. per unit, would cost £221. The comparative annual working cost of the two offers should therefore read: Electric Light Company, £505 10s., *plus* £221 = £726 12s.; Gas Company, £551 17s. 6d. The Clerk explained that the letter had been acknowledged, and a copy of it sent to Mr. Graham Harris, who had replied as follows:—

> I have read the letter and report, and re-read my reports, and I agree with the Gas Company's remark that there is nothing in the latter which justifies the statement that 12,000 units of electricity are equal in candle power to 3 million cubic feet of gas. It is obvious that with gas burnt in accordance with the most modern methods, 3 million cubic feet will give more candle power than 12,000 units of electricity. What I did say was that 12,000 Board of Trade units should be an ample supply for lighting, and should leave a substantial margin for the power used in the fire-pump. But I would point out that the question of the amount of light to be gained from gas or electricity has nothing whatever to do with the problem, so long as there is enough of that which is to be employed; and that the real point is the minimum charge per annum (irrespective of the amount of gas or electricity used) which you will have to pay to either of the two Companies, both of them insisting as they do on a minimum annual payment. The minimum charge per annum for the Gas Company is £426 17s. 6d., exclusive of the cost of the renewal of mantles, which would add another £35 to £50 per annum. This brings the total annual payment for gas, without any cleaning or attention, to (say) £461 17s. 6d. The minimum charge per annum for the Electric Light Company is £348; this sum including the renewal and cleaning and maintenance of the lamps and shades, &c.—in fact, covering all that was wanted.

In reply to a question as to whether there had been a supplementary offer as to the minimum quantity of gas the Company were prepared to supply, the Chairman (Dr. Dalton) said that he was partly responsible, owing to a statement he had made in the Town Council, for the prevailing idea that the Company insisted upon a minimum of 3 million cubic feet. At the time he was justified in making the statement, as Mr. Graham Harris had said the minimum mentioned was too high, and he would try to get it reduced. The Company had now offered

to supply a minimum of a million cubic feet; and this would entirely alter the estimates that had been arrived at.

A letter was then read from the Gas Company, in the course of which they said:

The minimum amount of 3 millions was fixed by Mr. Graham Harris, and was based, as we are given to understand, upon the amount used at the Asylum last year. The Directors had no intention of creating a position that might involve the Visitors in having to pay a considerable sum of money for gas not required; and as it has been suggested that an amount of light equivalent to a million cubic feet of gas would be sufficient, they are prepared to amend their offer by reducing the minimum to this amount—the discount to remain as previously stated, at 22½ per cent. up to 3 millions, and 25 per cent. for excess, if any. It must be understood that in reducing the stipulated minimum from 3 million to 1 million cubic feet, the Directors do not in any way guarantee that the smaller amount will be found sufficient for lighting the whole of the Asylum buildings and grounds, as they have no knowledge of the amount of lighting required.

The Chairman explained that the business before the meeting was the appointment of five representatives of the Visitors to meet a Sub-Committee of the Town Council and a Sub-Committee of the Finance Committee of the County Council specially appointed for the purpose, as the whole matter of the lighting of the Asylum had to be gone into afresh. The representatives were then appointed.

The subject was also under discussion at a meeting of the Cambridge County Council held on the preceding Saturday. At the previous meeting the following resolution was passed: "That the Finance Committee be empowered to consent to an expenditure by the Visitors of the Fulbourn Lunatic Asylum of a sum of £2100, of which the county's share is £897 8s. 1d., in lighting the Asylum with electricity." Mr. Harding-Newman moved that this resolution should be rescinded; and he quoted figures to show that there would be a saving of £417 per annum by using gas instead of electricity. Mr. H. O. S. Ellis seconded the motion; saying the Council now knew that the annual cost of lighting by gas would be less than that of lighting by electricity, while, according to Mr. Graham Harris's report, the first cost of it would be lower. Mr. Webber moved the following amendment, on the ground of urgency: "That the Finance Committee be empowered to consent to an expenditure of a sum not exceeding £1000 by the Visitors of the Fulbourn Asylum, as the county's share of the cost of lighting the Asylum with gas or electricity." He said this amendment, if agreed to, would give the Committee a free hand up to £1000 as to the adoption of either method of lighting. His reason for moving it was that if the motion was carried the whole matter would be shelved for about three months, as it could not be mentioned in the Council again until the next quarterly meeting in November, unless a special meeting was called. The amendment having been seconded, Mr. Harding-Newman said he was perfectly willing that the question should be referred to the Finance Committee. He was only too pleased to do anything that would facilitate matters to get the thing settled. On being put to the vote, the amendment was unanimously carried.

THE WATER-PIPE CONTRACT FOR PRAGUE.

In the last issue of the "JOURNAL," it was briefly announced (p. 606) that the management of the Prague Water-Works had decided to allot the contract for the pipes for their new distributing system to the French Company at Pont-à-Mousson. The current number of the "Engineer" furnishes the following explanation of this action: "In all the history of racial conflicts in Austria-Hungary there has probably never been such an extraordinary development as in the matter of the contract for the supply of water-pipes to the City of Prague, which has just been awarded to a foreign firm, whose bid was considerably higher than that of the home manufacturers. The quantity required was somewhat large—about 1600 waggon loads. There were two bids—the the Austrian iron-works cartell, amounting to some 3,000,000 crowns, or £125,000, and the French iron-works at Pont-à-Mousson, which was nearly 300,000 crowns (£12,500) higher. The precise figures upon which the contract was given out were: From the French works, 18·98 crowns (15s. 10d.) per 100 kilos., delivered at Furth, a station on the Bohemian frontier 119 miles from Prague; and from the Austrian works, 18·80 crowns (15s. 8d.) delivered at Prague. From the outset there was a strong agitation on the part of the Czech majority in the Water-Works Commission to give the contract to the French firm, because of the alleged Germanizing policy of the Directors of the Austrian cartell, whose principal works are in Bohemia. It was also charged against them that they were organized with German capital, and ought not to be favoured by the Czech nation. Just at the critical moment, however, the day before the contract was to be awarded, Herr Kestranek, the Chief Director of the Austrian iron industry, gave out a statement for publication which threw a new light on the whole affair. In this and in a subsequent statement, he told of offers which had been made to his Company by leading Czech politicians to secure them the contract in return for cash payments and other concessions, failing which threats were made that the order should go to France. One city official demanded 5 per cent. commission to be given to the members of the Water-Works Commission, and 2 per cent. additional for himself for his services in getting the contract. Another asked special favours from the cartell for a new screw factory which it was proposed to start; and yet another, a bank director, wanted concessions for some new iron-works. Herr Kastranek's disclosures naturally created much excitement, and it is probable that they had a good deal to do with the awarding of the contract to the French firm, as the Water-Works Commission feared to depart from their original intention lest the public should believe them guilty of the charges made by Herr Kastranek. There is general public indignation throughout Austria at this bestowal of a large contract upon a foreign firm, and it is not lessened by the reflection that such a thing would be absolutely impossible across the frontier in Hungary. So jealous are the Hungarians of the interests of their home industries, that in many cases the contracting for Government supplies—notably, for example, in the schools—is rigidly confined to Hungarian factories, even those in Austria being excluded."

SINKING WELLS IN LONDON.

In the last number of the "JOURNAL" (p. 602), we noticed a letter which had been sent to the papers by Mr. George Kebbell, cautioning people against sinking wells in London in the hope of obtaining a supply of water independent of that furnished by the Metropolitan Water Board. His point was that after incurring the expense of making a well, a consumer's supply might be seriously interfered with by similar operations carried on by a neighbour. Mr. Kebbell's letter was replied to by Messrs. C. Isler and Co., whose names are well known in connection with well-sinking. In the course of their letter they said: "With the introduction of artesian bored tube-wells, we do not hear of wells robbing one another; and if they did, there would be no occasion to bore deeper, but simply to lower the pump in the bore-hole. The cause of the failures in former days was due to the construction of the wells, but not to lack of water. This remark applies to the sinking which the East London Water Company carried out at Waltham Abbey some years ago. An adequate supply of water is obtained throughout London, if not from one water-bearing bed from another, as supplies can be developed by mechanical means. The water obtained from the deep-seated sources is not affected by the Thames in any way. If this were the case, the failure at Richmond, mentioned by Mr. Kebbell, would not have been possible. Anyone acquainted with the geological formation of London is aware that thick beds of clay overlie the water-bearing strata, and prevent any possibility of percolation from the surface. The analyses of all the wells, without exception, in the London basin, prove extreme purity and softness. As Kentish Town is named by Mr. George Kebbell, we may inform him that there are many wells there and in the district yielding abundant and unfailing supplies of extremely pure water; and there are thousands of wells in the London basin all yielding an abundant supply. In conclusion, the putting down of a well is a sound investment, and not a gamble in any way." Messrs. H. Richards and Co. wrote to the effect that they had completed a well 350 feet deep at Waltham Abbey, and were pumping continuously 6000 to 7000 gallons of water per hour from it. With reference to wells in the City of London, they said: "These are not affected by the river at all, as all surface or contaminated water is effectually shut out by means of wrought-iron or steel tubes driven firmly into the chalk some 200 feet down. The water is obtained from the chalk, and is perfectly pure for drinking purposes. The number of failures to obtain water from artesian wells is infinitesimal compared with those which are successful; and Mr. Kebbell is looking only on the dark side."

WATER CHARGES IN LONDON SUBURBS.

As some misunderstanding seems to have arisen in certain districts south of the Thames with regard to the new charges imposed by the Metropolitan Water Board for a "non-domestic" supply of water, the following explanatory statement appeared in "The Times" last Thursday.

The Board's Act of 1907 authorizes a uniform charge for water supplied for "domestic" purposes at a rate not exceeding 5 per cent. of the rateable value of the premises. For purposes other than "domestic," the Board are empowered to charge by meter, according to a scale which varies from 11d. per 1000 gallons when the consumption does not exceed 50,000 gallons to 6½d. per 1000 when it exceeds 5 million gallons. As an alternative, they may enter into agreements with individual consumers as to the rate to be charged. According to the Act, the watering of gardens by outside taps, hose, and "sprinklers," as well as the washing of horses, carriages, and motor-cars, is included among purposes other than "domestic." The demand notes for the current half year, therefore, in cases to which this rule applies, contain a charge, sometimes altogether new, for a "non-domestic" supply for gardens or horses and vehicles; and the sum so charged is often larger than the amount demanded for the "domestic" supply. The "non-domestic" charges vary considerably in a given neighbourhood.

These circumstances have led to a certain amount of confusion, and the officials of the Water Board are now engaged in endeavouring to deal with a mass of protests and demands for explanations. It seems that, owing to the wide area which is served by the Board, it has been impossible, as yet, to introduce a general system of supply by meter. In most districts the old charges are still maintained; but in the Lambeth and Kent districts new scales have come into operation, which the Board propose to make the subjects of agreement, as authorized by the Act of 1907, with those of their consumers who do not insist upon a supply by meter. In the case of gardens, no charge whatever is made when no outside tap, hose, or "sprinkler" is used. When there is a tap or hose, 10s. is charged for houses of a rateable value not exceeding £50, 15s. for houses rated up to £100, and 20s. when the rateable value does not exceed £200. These are summer charges only, and will not be repeated in the winter half year. If the premises exceed £200 in rateable value, or a "sprinkler" is employed, a charge varying from £2 2s., or (in some instances) a little less, to £3 3s. is made, according to circumstances. Thus in the case of two neighbours occupying houses rated at £50 each, one who uses only a hose in his garden may escape with a "non-domestic" charge of 15s., while the other who has a "sprinkler," may have to pay £2 2s. There is also a detailed scale for horses, carriages, and automobiles, under which the charges range from 6s. to 8s. for horses, 2s. 6d. to 10s. for carriages, and 20s. to a larger sum (according to horse power) for motors.

The following letter from Sir George Livesey, dated the 29th ult., appeared in "The Times" on Tuesday.

The case, the *Metropolitan Water Board v. Samuel*, reported in "The Times" of yesterday, is a skirmish under the new regulations, whereby the charge for water in certain cases greatly exceeds the value received, and on that ground is receiving general opposition. With your permission, I will put the case of gas companies. The greater part of the

water they use need not be pure, and is obtained from natural sources; but a small proportion of pure water is needed for drinking and washing for horses and men. I understand that the former is considered to be a trade purpose, and can be had by meter; but the latter is held to be a domestic supply, even where no men live on the premises, and must be paid for at a minimum charge of 5 per cent. on the assessment. The South Suburban Gas Company, whose works are at Sydenham, have had water by meter at a cost of £49 in the last year. They have been asked to sign an agreement to pay £221 per quarter, or £884 per annum, for that which hitherto has cost them less than £50, or 18s. for one shilling's worth of water. This is 5 per cent. on their assessment of nearly £18,000. Of course, the agreement was not signed, and the Company are waiting for the next step; but in the meantime they are sinking a well, which promises to be really artesian, to obtain a supply of pure water for the above-named purposes.

I have heard that the Water Board, having made reductions or abolished certain extra charges to private users, find themselves faced with a serious prospective deficiency, necessitating a rate-in-aid, unless they can make up the loss by these excessive charges to others. I think they recognize the injustice, but, being on the horns of a dilemma, are insisting on what they consider their legal rights under the Act of 1907. They may be mistaken; for the Courts may decide that the supply of water in such a case as the above is equally a trade purpose for horses and men. But, if not, Parliament will have to undo the injustice, and will undo it, if sufferers from the injustice do not tamely submit.

I cannot help feeling some satisfaction over this business, and hope it will be an eye-opener to the great number of people who have hazy notions on the subject of municipal trading. The public may have thought that public companies "chastised with whips;" but they are now learning that the public authorities to whom the business of the companies has been transferred "chastise with scorpions." Let London take heed, and not allow the purchase of the docks, for which no necessity has been shown, and which will, if carried, inevitably make London a dearer port.

NOTES FROM SCOTLAND.

From Our Own Correspondent. *Saturday.*

The accounts of the Aberdeen Corporation Gas Department for the year to July 31 have been published. They show that the revenue from gas, with the prices at 2s. 7d. for lighting, 26 cubic feet for 1d. for prepayment meters, and 2s. 4d. per 1000 cubic feet for engines, amounted to £92,688, compared with £89,529 the previous year. Of the total sum, £75,150 was derived from ordinary consumers, £7028 from power consumers, £10,479 from prepayment meter consumers, and £30 from meter-rents. There was received for residual products £25,790, as compared with £20,597; from house services, £1189, as compared with £1100; from gas-stoves, £1385, as compared with £1388; and from rents and feu-duties, £129, the same as the previous year. The total revenue was £121,184, as compared with £112,746 the previous year, and £112,623 in 1906. The expenditure account shows that coal, at 17s. 6¾d. per ton, cost £66,698, as compared with £54,925; purifying materials (less £178 for waste lime and oxide sold), £1348; salaries and wages in the manufacturing department, £12,933; maintenance of works, £435; and maintenance of plant, £4503. The total expenditure in the manufacture of gas was £86,331. Distribution cost £3897, as compared with £3596; and was made up of £1545 for wages of meter inspectors, £1196 for repairing and refitting meters, and £1155 for repair and maintenance of main and service pipes. House services cost £1014, compared with £962; gas-stoves, £1642, as compared with £1388. Rents, rates, and taxes amounted to £5859, as compared with £5588; management to £2006, as compared with £1949; general charges to £828, as compared with £892; and discounts and bad debts to £3883, as compared with £3743. In the cost of gas-stoves is included £805 written off for depreciation. The total expenditure was £105,463, as compared with £92,950—an increase of £12,513. The net profit for the year amounted to £15,720, as compared with £19,795. There have been paid: Annuities £4122, interest on mortgages, bank accounts, reserve fund, &c., £4218; and there has been carried to the sinking fund for the redemption of annuities £650, and for the redemption of mortgages £9853; and placed to reserve and fire insurance fund £300. A balance of £2787 is carried to the current year's account. Capital expenditure during the twelve months amounted to £5912, and makes the total capital outlay upon the undertaking to July 31 £355,143. The quantity of coal carbonized was 75,934 tons, and the yield of gas was 780,958,000 cubic feet, as compared with 725,301,000 cubic feet. The quantity of gas sold was 717,825,000 cubic feet; leaving 63,133,000 cubic feet unaccounted for, equal to 8·08 per cent., as compared with 5·08 per cent. the previous year. The gas made per ton of coal was 10,211 cubic feet.

There are two items of news this week relating to the gas supply of the Busby district. In the Glasgow Town Council on Thursday, Bailie M. W. Montgomery, in moving the minutes of the Gas Committee, in which it was recommended that the Corporation should purchase the pipes and mains of the Busby Gas Company so far as situated within the Glasgow area of supply, said that the objectionable conditions attached to the sale had been withdrawn unconditionally, and it was now a simple sale, with no conditions attached to it. They tried to meet the Busby ratepayers, and agreed to approach the Busby Gas Company, to see whether the Corporation could acquire the Company's undertaking on reasonable terms. The terms, however, were not, in the Committee's opinion, equitable or reasonable, and so they were thrown back to buy up only the portion within the Corporation's gas supply area, at the price of £9000. He hoped the Corporation would accept the recommendation of the Committee, because he thought it was the very best thing they could do in the circumstances. Mr. Alston moved, as an amendment, that the minute be disapproved. They were, he said, paying £9000 for practically nothing. If they acquired the plant the next day, the first thing they would require to do would be to provide new mains and meters. He was entirely opposed to the purchase being carried out on the lines suggested. The amendment was not seconded; and the minute was approved. The other item is that at a meeting of the Cathcart Landward Committee of the Renfrew County Council this week, a deputation from the Busby Ratepayers' Association was received, on the subject of the proposed purchase by the Glasgow Corporation. The deputation stated that they had met the Corporation Gas Committee, and had urged them to purchase the whole of the Busby concern, but that the Ratepayers' Committee were reminded that the Corporation had no power to supply gas outside their statutory area, and that if they sought power, opposition would probably be forthcoming from the County Councils of Lanark and Renfrew. The Ratepayers' Committee then submitted a new proposal, which was that the Corporation should supply gas to Busby at 3s. 11d. per 1000 cubic feet, as they were doing in Milngavie, where they had purchased a similar gas undertaking; and that the Corporation should meantime delay consideration of the acquisition of part of the Busby undertaking, so as to allow the Ratepayers' Committee time to approach the County Councils of Lanark and Renfrew and endeavour to arrange matters with them. The Gas Committee accordingly, it was reported, agreed to delay consideration of the proposed partial purchase until they heard further from the Ratepayers' Committee. After discussion, the Landward Committee unanimously agreed to recommend the District Committee of the County Council of Renfrew not to offer any opposition to the acquisition of the whole of the Busby undertaking by the Corporation of Glasgow. The two items of information do not seem to quite agree; but in the evolution of this somewhat tangled affair, they may be found in time to be quite in harmony.

The condition of disorganization into which certain of the financial departments of the Dundee Corporation had been allowed to fall is strikingly brought home by a report which has been presented to a Special Committee of the Town Council by Mr. W. M. Burke, the newly-appointed Gas Treasurer. In his report, Mr. Burke states that he entered upon his duties on July 1 satisfied that there was a distinct lack of supervision and control, which made it impossible to undertake the work of reorganization without the help of a thoroughly capable and trustworthy superintending clerk. It was obvious that such an appointment meantime could not be made from the *personnel* of the staff. He therefore made it his business to confer with Treasurer Urquhart, his prospective Convener; and he had his approval for the appointment of such a superintendent outside the scope of local influences and prejudices. He accordingly appointed Mr. John B. Thomson to the position; and he entered upon his duties along with him on July 1. Mr. Thomson was an entire stranger to him and to the staff. The appointment was reported to the Committee, and was approved by them. What had transpired since had fully justified the appointment. It was necessary to emphasize the fact, however, that Mr. Thomson's appointment did not create a new office, and he was not meant to be an addition to the staff, which would be reduced to at least its normal number as soon as efficient administration would permit. It was quite evident that the departmental system of control in the office was loose and unsatisfactory, and an absolute lack of discipline prevailed. With a few outstanding exceptions, every clerk of any responsibility acted on the principle of every man being his own master; and he was aware that a feeling hostile to discipline still pervaded a certain section of the staff. This had resulted in a want of cohesion so essential to efficient public service. With time, this would be put right. He had found it necessary to dismiss one of the gas office staff, and had appointed a local man in his place. The present office day was much broken up, and, to his mind, wasted, on account of the meal-hour arrangements. He therefore proposed to institute a universal dinner hour from one to two o'clock p.m. and a universal tea hour from five to six o'clock for the whole staff, with the exception of the caretaker and a junior clerk to attend to the telephone, &c., while the office was closed at these times. He expressed the opinion that it would be possible to effect considerable annual economy in the staff wages and salaries, and it would be his duty to accomplish this. He assured the Committee that nothing harsh would be done, or indeed anything drastic or revolutionary undertaken without their full knowledge and approval. The system of recording surpluses and deficiencies, so much criticized by previous Committees, existed when he took office. This he regarded as an encouragement to inaccuracy and petty dishonesty. No surplus or deficiency was now allowed to be recorded, and they had a regular, true balance without difficulty. In spite of the standing orders of the Council of June 9, 1881, no record of postage or car checks was kept, although these in the Gas and Electricity Departments alone aggregated £230 last year. A detailed record of these had been instituted. The question of duplicate keys for cash drawers and tills was untouched, but had been thoroughly investigated, and the duplicates had been collected and lodged in the safe. No man in charge of cash could now with any possibility of success blame any other person for deficiency occurring in the cash under his charge. In this connection he mentioned that he collected one of the duplicate keys from a man now resident in the south-west of Scotland, who had been dismissed from the Corporation service some years ago. Absolutely no system of check at all had obtained for the passing of cash from one clerk to another. Wherever money passed in this way now a receipt must be given by the party receiving to the party handing over. In the general office system he found a want of method, or the method that prevailed antiquated or insufficient. This had been and was, as opportunity afforded, put right. Bad and doubtful debts due to the undertaking were being pushed for and pressed to a definite business issue with considerable success. Large payments for wages had been in the habit of being made outside the office without a receipt from the receiver or a certificate from the payer being got. This had been altered so as to secure a business-like guarantee that the monies were being duly received by the parties for whom they were intended. The whole system of book-keeping in the office was being overhauled and revised; and a thoroughly up-to-date and efficient system would be introduced as soon as possible. In the City Chamberlain's Department, he found that payments to pensioners, amounting to thousands of pounds annually, were neither vouched for nor certified, though many of the pensioners sent mere children for their allowances. This, so far, had been rectified, and was still the subject of investiga-

tion. The book-keeping in the Weights and Measures Department he found in a complete state of chaos, if it could be termed book-keeping at all. The Committee, by five votes to two, decided to recommend the Council in terms of the report.

In a specially contributed article in the "Dundee Advertiser" of Tuesday, the passage occurs: "Cupar has very seldom reason to complain about its gas, although, of course, it reserves itself the right to grumble at the price when the gasman makes his periodical visits. It is not the price, however, that is troubling the town just now—that may come later when the meters are being checked. The present difficulty is the quantity. Curiously enough it is only a section of the community that is complaining. Many shopkeepers and householders get all they want; but others have to submit to a reduced supply. The nights are drawing in now, and as the Daylight Saving Bill was not passed, shopkeepers have to light up before closing time. If the Bill were to come before the Town Council just now, probably that body would be moved to petition in favour of it. In any case, several consumers cannot get enough light to illuminate their premises, and one lady had to kindle the fire in order to cook the breakfast the other morning. The summer is not altogether past, and people are not very anxious to have coal-fires. The natural explanation would be that there is something wrong with the service-pipes; but the plumber asserts that they are not to blame. The official explanation is that naphthalene has got into the pipes. Those versed in chemistry can give a very lucid and learned explanation of the origin and action of this wonderful element; but the effect of it (the naphthalene, not the explanation) is to choke the pipes. The Gas Company recognize the difficulty, and are at present fitting up a washer at the works with the view of extracting the naphthalene before it gets into the main. It is to be hoped they will be successful."

Visit of the Manchester Gas Committee to London.—At the meeting of the Manchester City Council last Wednesday, a resolution was submitted from the Gas Committee to the effect that the members should visit the Franco-British Exhibition, in order to view the latest improvements in gas apparatus and appliances shown there. Alderman Gibson, in support of the resolution, said that ever since the Gas Exhibition was held in the city he had been thinking how they could best utilize the premises in Deansgate as suitable show-rooms for letting the public know how to improve the lighting in warehouses, shops, and houses; and therefore a visit to the Exhibition in London would prove of considerable use. Mr. O. Heggs caused some amusement by asserting that after every visit the Gas Committee had paid to these exhibitions the quality of the city gas had steadily deteriorated; and he said he was afraid that if the proposed visit were allowed the city would be absolutely without a light. The resolution was, however, accepted by the Council. The intention of the Committee was to leave Manchester on Thursday at midday, and visit the Exhibition in the evening, and probably again on Friday; returning in the evening of that day or on Saturday.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Sept.* 5.

Quietness has prevailed throughout the week, there being but few fresh orders on the market; and, production being on an increasing scale, prices have further declined. The closing quotations are £11 5s. to £11 6s. 3d. per ton f.o.b. Hull, £11 7s. 6d. to £11 8s. 9d. per ton f.o.b. Liverpool, and £11 12s. 6d. per ton f.o.b. Leith. Interest in the forward position has disappeared. The large makers are still quoting £12 2s. 6d. to £12 5s. per ton, according to port, for delivery over the spring months, and £11 17s. 6d. to £12 per ton for October-March; but no further important business has been reported.

Nitrate of Soda.

This article has also been very quiet, but the spot quotations are still maintained at 10s. per cwt. for 95 per cent. and 10s. 3d. for refined quality.

Tar Products. LONDON, *Sept.* 7.

With the exception of creosote, tar products are still very quiet. Pitch is reported better in some quarters; and bottom prices are thought to have been reached. Creosote is very brisk in all parts, and 2⅞d. to 3d. is asked in Scotland for delivery to the end of the year. Benzol and toluol are without interest. Solvent is fairly steady, and prices remain unchanged. Carbolic is weak, and business is impossible, except at extremely low figures. The position of naphthalene and salts is unchanged.

The average values during the week were: Tar, 11s. 6d. to 15s. 6d., *ex* works. Pitch, London, 18s.; east coast, 17s. 6d. to 18s.; west coast, 16s. 6d. to 17s. 6d., f.a.s. Benzol, 90 per cent., casks included, London, 7d. to 7¼d.; North, 6¾d. to 6⅞d.; 50-90 per cent., casks included, London, 7d. to 7¼d.; North, 6¾d. to 7d. Toluol, casks included, London, 7¼d. to 7½d.; North, 6⅞d. to 7d. Crude naphtha, in bulk, London, 3¼d. to 3½d.; North, 3d. to 3¼d.; solvent naphtha, casks included, London, 10d. to 10½d.; North, 9d. to 9½d.; heavy naphtha, casks included, London, 9⅜d. to 10¼d.; North, 8⅜d. to 9¼d. Creosote, in bulk, London, 2⅝d. to 2¾d.; North, 2⅜d. to 2⅝d. Heavy oils, in bulk, 2¼d. to 3d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 2½d. to 1s. 3d.; west coast, 1s. 2d. to 1s. 2½d. Naphthalene, £4 10s. to £8 10s.; salts, 35s. to 37s. 6d., packages included and f.o.b. Anthracene, "A" quality, 1½d. to 1⅝d. per unit, packages included as well as delivered.

Sulphate of Ammonia.

This remains unchanged. The principal London Gas Company still quote £11 17s. 6d. for delivery to the end of the year. Outside London makes £11 7s. 6d. to £11 8s. 9d., Hull £11 6s. 3d. to £11 7s. 6d., Liverpool £11 8s. 9d., and Leith £11 12s. 6d. for this year's delivery and £12 to £12 5s. for January-June are about the ruling prices.

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COAL TRADE REPORTS.

Northern Coal Trade.

There is some change in the trade of the North—the advance of the season having influenced both the gas-coal and the steam-coal trade. In the steam descriptions, the demand for best Northumbrians is strong for prompt delivery, and easier for forward; the price varying from about 14s. 3d. to 15s. per ton f.o.b., according to the time fixed on. Second-class steams are from about 12s. to 12s. 6d. per ton, and steam smalls vary from 5s. 6d. to 6s. 6d. The production of steam coals is well taken up, and for the present seems likely to be so; but the forward sales are not quite as full as could be desired. In gas coals, there is a good and improving demand. The exports are heavy, and the home consumption shows the growth usual at this season to be even more rapid than is generally the case—possibly because the contrast is with last year, when more Yorkshire coal was being sent to the South. Durham gas coals are quoted from about 10s. 6d. to 11s. 6d. per ton f.o.b. for the customary kinds, and from 11s. 9d. to 12s. for "Wear specials." There has not been much done in the way of contracts of late. Small lots sold have been at prices that are near those currently quoted, but with a slight reduction when delivery is over a period. There is a steady demand for coke, and gas coke is firm at 16s. to 16s. 6d. per ton f.o.b.

Scotch Coal Trade.

The market remains unchanged. All sorts for shipment are in good request. The home demand for immediate delivery is not improving; but there is a somewhat extensive inquiry for forward delivery—several important contracts of this description having been entered into. The prices quoted are: Ell, 10s. 9d. to 12s. 6d. per ton f.o.b. Glasgow, splint 10s. 9d. to 11s., and steam 10s. to 10s. 3d. The shipments for the week amounted to 312,636 tons—a decrease upon the preceding week of 9442 tons, and upon the corresponding week of 12,341 tons. For the year to date, the total shipments have been 9,306,106 tons—438,787 tons less than in the corresponding period.

Thefts from Gas-Meters.—Charles Clifford and Thomas Bolton were charged before the Magistrates at the Caversham Petty Sessions, a few days ago, with stealing money from gas-meters the property of the Reading Gas Company. The prosecuting Counsel said the Company had 1000 meters in Caversham, and much difficulty was experienced in getting a conviction. On the other hand, the ease with which the meters could be broken open by boys in the houses of their parents was very great. The Inspector of the police referred to other cases where meters had been broken open by a gang of boys of which the two accused were members. The Chairman (Mr. C. D. Rose, M.P.) said the public must be protected against such lads; and he sentenced them to six weeks' imprisonment with hard labour.

Reductions in Price.

The Douglas (Isle of Man) Gas Company have reduced the price of gas 1d. per 1000 cubic feet as from the 1st prox. As from the 29th inst., the price of gas in Plymouth and Stonehouse will be 1s. 10d. per 1000 cubic feet. This is a reduction of 1d., and removes half the increased charge caused by the high price of coal twelve months ago. The Directors of the Harrogate Gas Company have reduced the price of gas 2d. per 1000 cubic feet as from the 1st of July. At the meeting of the Longton Town Council last Thursday, the Gas Committee recommended as follows: That the price of gas consumed for lighting, heating, and cooking purposes by the ordinary meter be reduced to 2s. 9d., less 3d. discount, or a net price of 2s. 6d. per 1000 cubic feet if paid within the usual month from the delivery of the account; the price of gas for consumers outside the borough to be 3s. 3d., less 3d. discount, or a net price of 3s., if paid within the usual month. That the price of gas to slot-meter consumers be reduced 3d. per 1000 cubic feet, both inside and outside the borough; that the price of gas used for public lighting purposes be reduced from 2s. 6d. to 2s. 3d. per 1000 cubic feet net; and that the price of gas used for motive power purposes be reduced 5 per cent., according to a schedule submitted. The recommendations were agreed to; and the reductions will take effect from the reading of the indices for the September quarter. In addition to these reductions, the Gas Committee will hand over £3000 in aid of the rates. Otherwise the selling price will be 2s. 1d. instead of 2s. 6d. The Amble and Warkworth Gas Company notify that the price of gas will be reduced from 5s. 10d. to 5s. per 1000 cubic feet, and also that rents for slot-meters will be discontinued.

New Joint Stock Companies.—The Leven and Methil Gas Company, Limited, was registered in Edinburgh last week, with a capital of £30,000, in £1 shares, for which the public are not invited to subscribe. Peter and Mark Hurll, Limited, brick, &c., manufacturers, of Glasgow, was also registered in Edinburgh last week, as a private company. The capital is £50,000, divided into 25,000 ordinary and 25,000 preference shares of £1 each.

Mitcham and Wimbledon District Gas Company.—At the recent half-yearly general meeting of this Company, the Directors reported that the balance of profits on the working in the six months ending June 30 was sufficient to pay the standard dividend (less income-tax), provide a sum of £900 to form the nucleus of an insurance fund, and add £285 to the balance of net profit to be carried forward. The total revenue was £59,750; the expenditure, £49,263; and the balance carried to the profit and loss account, £10,487. The amount available for dividend was £15,390. There was a satisfactory increase in the sale of gas and in the revenue from residuals. During the half year, extensive reconstruction works were undertaken, under the supervision of the Engineer and Manager (Mr. B. R. Green), to bring the plant up to date, with a view to economical working. These, the Directors stated, had progressed favourably, and would shortly be completed.

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Reduction in Price at Warrington.

The minutes of the Gas Committee submitted at the monthly meeting of the Warrington Town Council last Tuesday contained a recommendation that the price of gas be reduced by 2d. per 1000 cubic feet as from Nov. 1 next. Alderman Pierpoint moved the confirmation of the minutes, and pointed out that the reduction would mean £2650 per annum. It would bring down the price to the ordinary customers to 2s. 2d. per 1000 feet, to the large consumers to 2s. 1d., and to the specially large consumers to 2s. The price of power gas would be reduced from 1s. 8d. to 1s. 6d. The profit of the department in 1907 was £15,593; and out of this they devoted £11,500 to the relief of the rates, and transferred £4093 to the reserve fund, which now stood at £10,000. He believed the reduction of price would mean increased consumption; and by encouraging the use of gas fires and cookers it would lessen the smoke nuisance. Mr. Pemberton did not think that there was any town to approach Widnes with regard to the lowness of the price of gas; and there it had been found that by constantly reducing the charge the consumption had been increased. Warrington would compare favourably with any town in England with respect to electricity for power purposes; and if they placed the gas on the same footing, there was no reason why new works should not be brought to the town. The minutes were approved.

The Proposed Yellow Prussiate Plant for Halifax.

For some time past the Gas Committee of the Halifax Town Council have had under consideration the advisability of erecting a plant for the extraction of cyanides and the manufacture of yellow prussiate by the Davis-Neill process; and the following report on the subject has been drawn up: "With reference to the question of Messrs. Swallow's offer to erect a cyanide plant at our works, we may say that we obtained a fair amount of inform tion regarding the matter during the meeting of the Institution of Gas Engineers in London, and the Engineer has also been obtaining the personal advice of those actually engaged in the trade outside of gas-works. But the present outlook is so uncertain, so far as the market value of prussiate is concerned, that we feel it would be wise to let the matter stand over for a few months. We may further add that, as the result of negotiations with Messrs. Swallow, they have reduced the proposed actual cash payment from £4000 to £2000; but notwithstanding this offer, it does not appear that anything will be lost by waiting a few months and carefully watching the prussiate market. It may be that the present decreased value of prussiate is only temporary; but as this is a new business so far as the Halifax Corporation are concerned, we feel it would be better to await the result of a falling market, and see what the recuperative power of such market is likely to be. The few months' delay will also provide the Committee with the results of the Engineer's tests for cyanogen over a longer period; and such tests can then be compared with the information obtained by the Committee, when visiting Liverpool."

Natural Gas in Kansas City.—The British Vice-Consul in Kansas City, in a report just issued by the Foreign Office on the trade of the consular district of Chicago, says that the city is supplied with natural gas, which is almost entirely used for lighting and domestic purposes; the quantity at present available not being large enough to enable the Gas Company to sell it to manufacturers. The rate charged is 25c. per 1000 cubic feet.

Public Lighting at Biddulph.—The Town Clerk (Mr. E. A. Plant) reported at a meeting of the Congleton Gas Committee that the Biddulph Urban District Council had approved of suggested terms in connection with street lighting in Biddulph by the Corporation, and were willing to support any application by the Corporation for power to supply gas in the Biddulph district. It was resolved "that the Town Clerk take the necessary steps for having a Bill drafted to enable the Corporation to carry out the proposed scheme." The Town Council have adopted the recommendation; but it was pointed out that the minute of the Gas Committee did not mean that they were finally committed to carrying out the scheme.

Gas Company's Offer of Free Land.—Referring to the offer made by the Leighton Buzzard Gas Company of a two-acre plot of land to any firm who will undertake to erect a factory upon it, the Company's Engineer (Mr. C. F. Ruggles) explained to a representative of the "Daily Express" a few days ago that they, of course, expected to derive some benefit from the extra quantity of gas they would sell to the owners of the factory and to the workmen; but beyond this they thought that if one factory was erected, others would follow. The plot is bounded on one side by a street communicating with the centre of the town, and on another it has a frontage of 150 feet on the London and North-Western Railway line. A portion of the site adjoins the railway goods yard.

Gas Supply, Traction, and Power in Bahia.—In a report which has just been issued by the Foreign Office, the British Consul at Bahia states that the Bahia Tramway, Light, and Power Company, which has been organized for supplying gas in Bahia and the surrounding districts and for other objects, has acquired the tramway system of the lower city. The Company's authorized capital is $7,500,000, of which amount there were issued $2,804,400 for public subscription during last year in the shape of 5 per cent. first mortgage debenture bonds. The Consul understands that much of this issue was subscribed in the United Kingdom. The Company have acquired by purchase the interests of the Compagnie d'Eclairage de Bahia, a Belgian Corporation, who had secured the exclusive right to manufacture and sell gas and distribute electricity in the city and suburbs until the end of 1950. The new Company hope to be instrumental in greatly extending the use of gas for cooking purposes as well as for illumination. In order to provide for the anticipated demand the Company have entered into a contract with Messrs. Dick, Kerr, and Co., Limited, for increasing the existing gas plant, and for installing a first-class light and power plant, to be worked by gas-engines.

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Gas Lighting for Rottingdean.—Rottingdean is about to be supplied with gas for the first time by the Brighton and Hove Gas Company, who have already commenced main-laying operations. Circumstances are combining to revive the prosperity this quaint seaside place enjoyed a hundred years ago.

Penmaenmawr District Council and the Gas-Works.—At the meeting of the Penmaenmawr Urban District Council last Wednesday, it was unanimously decided, after much deliberation, to offer the Holyhead and North Wales Gas Corporation £11,000 for the works at Penmaenmawr, subject to the sanction of the ratepayers and the consent of the Local Government Board.

Stockport Gas Committee and their Inspectors.—It may be remembered that about two months ago the discharge of a meter inspector by the Stockport Gas Committee led to a threat to strike by the employees of the Gas Department; but though the official was not reinstated, as requested by the Municipal Employees Association, the men did not act upon their resolution. It was denied at the time by the Chairman of the Committee that the official's dismissal had anything to do with the part he had taken in organizing the gas employees and in agitating for improved conditions on behalf of the meter inspectors. The Committee have decided that it is unnecessary to make any alteration in the conditions of labour of the meter inspectors, as required by the Association, with the exception of travelling expenses, which will be allowed in special cases at the discretion of the Engineer. The Committee state that alterations in the duties of the inspectors have from time to time been effected, and that such alterations have met with the wishes of the men, who are content with the existing arrangements.

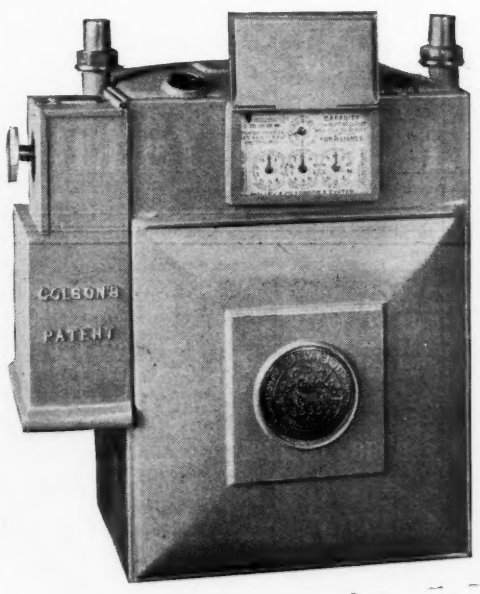
A Council's Unsatisfactory Financial Position.—At the last meeting of the Malvern Urban District Council, a letter was read from Mr. Edward Stevens, the District Auditor, in which he pointed out that the financial position of the Council continued to be unsatisfactory; the amount overspent on the general account being £4293—a very serious state of things. Meanwhile, cheques were held back for want of funds, the Council were being pressed for money by contractors and others, discounts had disappeared from the accounts, and the credit of the Council was seriously impaired. It was, he said, quite evident the Council had not raised sufficient money for their ordinary business, after making due allowance for the extraordinary expenditure in litigation, which to a certain extent might have been unforeseen. The Council's policy in charging themselves with full, instead of cost, price for gas, as involving payment of income-tax on profits not earned, was also criticized. The Chairman of the Finance Committee (Mr. A. Sparkes) said the Auditor's reference to the insufficiency of the sum raised by the district rate was well founded. It was stated that the Council used £2000 worth of gas per annum, and that by adopting the Auditor's suggestion to only debit themselves at the rate of 1s. 6d. per 1000 cubic feet, which it was decided to do, a saving of £50 per annum in income-tax would be effected.

Local Authorities' Gas Profits.—Referring to this subject last Friday, the "Municipal Journal" said: "We are glad to see that the Warrington Town Council has decided to reduce the price of gas out of profits. As from the 1st of November next, a reduction of 2d. per 1000 cubic feet will be made, which represents a concession to the consumers of £2650 per annum. That the concession is more than justified is shown by the fact that the profit of the Gas Department last year was £15,593, of which sum £11,500 went to the relief of the rates. In our opinion, this is much too large a rate relief; and we hope the Council will persevere in its policy of reducing prices so that the consumption of gas will be increased by encouraging the use of gas fires and cookers. We see that Mr. Edward Stevens, the District Auditor, has laid down some curious principles in regard to this charges question in a report which he has just made to the Malvern Urban District Council. It seems that the Council has been charging itself for gas at the rate of 2s. 10d. per 1000 cubic feet, and that Mr. Stevens thinks a charge of 1s. 6d. would be sufficient. He says the Council has no right to 'make a profit out of itself. The profit, if any, is the cash profit made by the Council in their dealings with the outside public after all charges have been paid.'"

Bankruptcy of a Gas Engineer.—At the offices of the Official Receiver for the Wandsworth district, on Monday last week, the first meeting of creditors was held, before Mr. H. L. Howell, the Senior Official Receiver, under the failure of William Tice, gas engineer, of 15, St. James's Road, Upper Tooting. The statement of affairs filed by the debtor disclosed gross liabilities amounting to £500 13s. 6d.; and there were no assets. In or about 1895, the debtor commenced business at Carteret Street, Westminster, as a gas engineer. In 1896, he removed to Wellington Mansions, York Street, Westminster, and traded under the style of the Automatic Gas-Governor Company until June, 1907, when he altered the style to Tice and Co. The business was successful until June, 1902, when, owing to the postponement of the Coronation of the King, he made a loss to the extent of £500. In February, 1907, his wife commenced business on her own account as the Automatic Gas-Governor Company at 15, St. James's Road, Upper Tooting. He acted as her Manager without remuneration, and continued in this capacity down to the date of the receiving order. He attributed his failure to having been caused to incur costs in a partnership action, and expenses in exploiting a patent. Eventually the estate was formally left in the hands of the Official Receiver for summary administration in the usual manner.

The South Shields Gas Company have paid an interim dividend of 4 per cent. (less income-tax) for the past half year on the consolidated and new stocks.

The Southport Corporation have placed an order with Messrs. Robert Dempster and Sons, Limited, of Elland, for building eleven through retort-arches, chimney, &c.



COLSON'S PATENT CASH BOX

EFFECTUALLY PREVENTS THEFT OF CASH FROM PREPAYMENT METERS.

Can be supplied Fitted to

THE "WILLEY" METER.

WILLEY & CO., Ltd., LONDON AND EXETER.

Mr. H. J. Farnol has taken the position of managing London representative for Messrs. Hands and Co., of Farringdon Road.

The British Consul-General at Barcelona, in his annual report, points out that there is increased use in the city of engines worked by producer gas; and in consequence the consumption of anthracite coal, all of which is imported from Swansea, is growing yearly. There are large deposits of anthracite in Spain; but so far the samples put on the market have not proved sufficiently good to oust that which is imported from Swansea.

We have received Messrs. Falk, Stadelmann, and Co.'s new "Veritas" incandescent light catalogue (No. 277). It consists of 82 large quarto pages, in which will be found illustrated particulars and prices of mantles, burners (both upright and inverted), chimneys, globes, &c., in practically endless variety. Included in the catalogue is a distance incandescent gas lighter worked by air pressure only. At the end are given a commercial index and a telegraphic code.

There has been a burst at Agecroft of the 36-inch main of the Manchester Corporation conveying water from Lake Thirlmere to the Prestwich reservoirs. The consequent rush of water carried away a portion of the high road in Agecroft Lane, and found its way into one of the neighbouring lakes formed in the district as a result of the local colliery operations. Otherwise a serious flood must have been the result. No great damage was done, though some inconvenience was caused by the stoppage of the water supply.

The Bat Meter Company, Limited, has been registered with a capital of £20,000, in £1 shares (12,000 preference), to carry on the business of manufacturers of, and dealers in, gas, water, and electricity meters, &c.

The third and last party of the employees of the East Hull Gas Company had their outing to Scarborough last Wednesday week, when a pleasant day was spent. After dinner, at the Grand Hotel, Mr. Pipes, in proposing a vote of thanks to the Directors, said he thought the outing would help to foster the good feeling which existed, and make the employees realize more clearly that they all (whatever their duties or positions might be) were a united body, and had but one end in view—namely, the good of the Company. During the last six years, under the new management, the Company's business and prosperity had increased by leaps and bounds; and in this prosperity workmen and consumers had also shared. More pay, shorter hours, and better conditions of labour had improved their lot; while the consumers had benefited by cheaper gas, better service and supply, and prompt attention to all requirements. Mr. J. J. Runton, the Chairman of the Company, in reply, remarked that they owed their thanks to Mr. Holliday for taking the matter up and bringing it before the Board, who were very pleased to grant the request for the outing. Mr. J. Holliday, the General Manager and Engineer, also spoke, and said if they stood shoulder to shoulder in the future, as they had done in the past, he felt sure the progress of the Company would go on at an even greater rate.

"ILLUMINATING TRUTHS."

LEAFLETS FOR DISTRIBUTION.

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."
No. 7.—"The Osram Lamp: Fiction and Fact."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.

Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Wanted.

FOREMAN. No. 4989.
GAS-FITTER, &c. Vaughan, Knighton.
MANAGER OR ASSISTANT. No. 4983.
MANAGER OR ASSISTANT. No. 4988.

Correspondence Classes.

LEES, H., Hexham.
CORRESPONDENCE COLLEGE COMPANY, Cambridge.

Plant (Second-Hand), for Sale.

GAS EXHAUSTER. John Adams and Sons, Newcastle.
RETORT BENCH MOUNTINGS, PIPES, &c. Lochgelly Gas Company.

Company Meeting.

OTTOMAN GAS COMPANY. London Offices. Sept. 15. One o'clock.

Patents to Sell or Licences to Manufacture.

PRODUCTION OF OIL GAS. H. Gardner and Son, Fleet Street, E.C.
TREATING COAL FOR COKING PURPOSES. Haseltine, Lake, and Co., Chancery Lane, W.C.

TENDERS FOR

Coke.

WANDSWORTH AND PUTNEY GASLIGHT AND COKE COMPANY. Tenders by Sept. 18.

Cookers, Heating Stoves, Fittings, &c.

BELFAST CORPORATION. Tenders by Sept. 17.

Meters.

BELFAST CORPORATION. Tenders by Sept. 17.

Oxide of Iron.

EDINBURGH AND LEITH CORPORATIONS' GAS COMMISSIONERS. Tenders by Sept. 14.

Tar and Liquor.

SHIPLEY URBAN DISTRICT COUNCIL. Tenders by Sept. 21.
WANTAGE URBAN DISTRICT COUNCIL. Tenders by Sept. 19.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 637.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl. 10	10	Alliance & Dublin 10 p.c.	19½—20½	..	4 17 6
268,324	10	,,	7	Do. 7 p.c.	13½—14½	..	4 16 6
310,000	Stk.	July 15	4	Do. 4 p.c. Deb.	99—102	..	3 18 5
100,000	5	May 29	6¼	Bombay, Ltd.	5⅝—6⅛	–¼	5 4 0
40,000	5	,,	6¼	Do. New, £4 paid	4—4½	–¼	5 15 7
50,000	10	Aug. 27	14	Bourne-mouth Gas and Water } 10 p.c.	28—29*	..	4 16 6
51,810	10	,,	7	Do. B 7 p.c.	16—16¾*	..	4 4 9
53,200	10	,,	6	Do. Pref. 6 p.c.	15—16*	..	3 15 0
380,000	Stk.	Aug. 13	12½	Brentford Consolidated	243—248	+1	5 0 9
300,000	,,	,,	9¾	Do. New	181—186	+1	5 2 2
50,000	,,	,,	5	Do. 5 p.c. Pref.	120—125	..	4 0 0
206,250	,,	June 12	4	Do. 4 p.c. Deb.	100—105	..	3 16 2
220,000	Stk.	Mch. 12	10⅔†	Brighton & Hove Orig.	210—215	..	5 0 0
246,320	,,	,,	7⅓†	Do. A. Ord. Stk.	154—159	..	4 17 6
460,000	20	Mch. 27	10	British	41—43	..	4 13 0
109,000	Stk.	Aug. 27	6	Bromley, Ord. 5 p.c.	113—116*	..	5 3 5
165,700	,,	,,	4½	Do. do. 3½ p.c.	84—86*	..	5 4 8
500,000	10	May 14	7	Buenos Ayres (New) Ltd.	11⅞—12⅛	..	5 19 1
250,000	Stk.	June 26	4	Do. 4 p.c. Deb.	92—94	..	4 5 1
150,000	20	July 15	7½	Cagliari, Ltd.	24—25	..	5 16 0
100,000	10	—	—	Cape Town & Dis., Ltd.	4—6	..	—
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.	5—7	..	6 8 7
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	48—50	..	6 0 0
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.	78—83	..	5 8 5
157,150	Stk.	Aug. 13	5⅝	Chester 5 p.c. Ord.	108½—110½	..	4 12 7
1,493,280	Stk.	Aug. 27	5½	Commercial 4 p.c Stk.	105—110*	..	4 14 6
560,000	,,	,,	5	Do. 3½ p.c. do.	101—103*	..	4 17 1
475,000	,,	June 26	3	Do. 3 p.c. Deb. Stk.	82—84	+1	3 11 5
800,000	Stk.	June 12	6½	Continental Union, Ltd.	108—113	–2	5 15 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	137—142	..	4 18 7
460,170	Stk.	—	5	Derby Con. Stk.	122—124	..	4 0 8
55,000	,,	—	4	Do. Deb. Stk.	103—105	..	3 16 2
148,995	,,	Mch. 31	5	East Hull 5 p.c. Ord.	100—103	..	4 17 1
486,090	10	July 15	12	European, Ltd.	22½—23½	..	5 2 2
354,060	10	,,	12	Do. £7 10s. paid	16½—17½	..	5 2 10
15,182,590	Stk.	Aug. 13	4/10/8	Gas-light and Coke } 4 p.c. Ord.	98—100	+1	4 10 8
2,600,000	,,	,,	3½	3½ p.c. max.	87—89	+½	3 18 8
3,799,735	,,	,,	4	4 p.c. Con. Pref.	104—107	..	3 14 9
4,193,975	,,	June 12	3	Coke 3 p.c. Con. Deb.	85—87	..	3 8 11
258,740	Stk.	Mch. 12	4⅔†	Hastings & St. L. 3½ p.c.	93—95	..	4 16 11
82,500	,,	,,	6⅔†	Do. do. 5 p.c.	112—115	..	5 8 8
70,000	10	Apl. 29	11	Hongkong & China, Ltd.	18—19	..	5 15 9
4,940,000	Stk.	May 14	8	Imperial Continental	180—182	–½	4 7 11
473,600	Stk.	Aug. 13	3½	Do. 3½ p.c. Deb. Red.	94—96	..	3 12 11
195,242	Stk.	Aug. 27	6	Lea Bridge Ord. 5 p.c.	116—120*	..	5 0 0
561,000	Stk.	Aug. 27	10	Liverpool United A	227—229*	..	4 7 4
718,100	,,	,,	7	Do. B	16½—16⅝	+1	4 4 1
306,083	,,	June 26	4	Do. Deb. Stk.	104—106	..	3 15 6
75,000	5	June 26	6	Malta & Medn., Ltd.	4⅞—5⅛	..	6 6 4
560,000	100	Apl. 1	5	Met. of } 5 p.c. Deb.	101—103	..	4 17 1
250,000	100	,,	4½	Melbourne } 4½ p.c. Deb.	101—103	..	4 7 5
541,920	20	May 29	3½	Monte Video, Ltd.	11—12	..	5 16 8
1,775,892	Stk.	July 30	4/12/6	Newc'tle & G'tesh'd Con.	107—103	+⅛	4 5 8
418,460	Stk.	June 26	3½	Do. 3½ p.c. Deb.	90—92	..	3 16 1
15,000	10	Aug. 27	10	North Middlesex 10 p.c.	19½—20½*	..	4 17 6
55,940	10	,,	7	Do. 7 p.c.	13—14*	..	5 0 0
300,000	Stk.	Apl. 29	8	Oriental, Ltd.	140—143	..	5 11 11
60,000	5	Mch. 27	7	Ottoman, Ltd.	6—6½	..	5 7 8
398,490	5	Apl. 29	7	Primitiva Ord.	5⅞—6⅛	..	5 12 0
796,980	5	July 30	5	Do. 5 p.c. Pref.	4⅝—5⅛	..	4 17 7
488,900	100	June 1	4	Do. 4 p.c. Deb.	95—97	..	4 2 6
1,000,000	10	Apl. 29	8	River Plate Ord.	13⅛—13⅜	..	5 16 5
312,650	Stk.	June 26	4	Do. 4 p.c. Deb.	92—94	..	4 5 1
250,000	10	Apl. 10	8	San Paulo, Ltd.	13⅜—14	..	5 14 4
125,000	50	July 1	5	Do. 5 p.c. Deb.	49—51	..	4 18 0
135,000	Stk.	Mch. 12	10	Sheffield A	245—246	..	4 1 4
209,984	,,	,,	10	Do. B	244—246	..	4 1 4
523,500	,,	,,	10	Do. C	243—245	..	4 1 8
70,000	10	May 29	10	South African	13—14	..	7 2 10
6,429,895	Stk.	Aug. 13	5/6/8	South Met., 4 p.c. Ord.	119—121	+½	4 8 1
1,895,445	,,	July 15	3	Do. 3 p.c. Deb.	84—86	..	3 9 9
209,820	Stk	Aug. 31	8	South Shields Con. Stk.	152—154*	..	5 3 10
605,000	Stk.	Aug. 13	5/6/8	S'th Suburb'n Ord. 5 p.c.	114—117	+1	4 11 1
60,000	,,	,,	5	Do. 5 p.c. Pref.	117—122	..	4 2 0
117,058	,,	July 15	5	Do. 5 p.c. Deb. Stk.	120—125	..	4 0 0
502,310	Stk.	May 14	5	Southampton Ord.	108—113	..	4 8 6
120,000	Stk.	Aug. 13	6½	Tottenham } A 5 p.c.	127—132	+10	5 2 3
398,940	,,	,,	5½	and } B 3½ p.c.	105—108	..	4 17 3
149,470	,,	June 26	4	Edmonton } 4 p.c. Deb.	100—105	..	3 16 2
182,380	10	June 12	8	Tuscan, Ltd.	10—10½	..	7 12 4
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	99—101	..	4 19 0
193,742	Stk.	Aug. 27	5	Tynemouth 5 p.c. max.	104—105*	..	4 15 3
255,636	Stk.	Aug. 27	6½	Wandsworth and Putney } B 3½ p.c.	124—129*	..	5 0 9
79,416	,,	June 26	3	} 3 p.c. Deb. Stk.	73—78	..	3 16 11
845,872	,,	Aug. 27	5½	West Ham 5 p.c. Ord.	100—103*	+1	4 19 6
185,000	,,	,,	5	Do. 5 p.c. Pref.	118—123*	..	4 1 3
228,300	,,	June 26	4	Do. 4 p.c. Deb. Stk.	100—105	..	3 16 2

Prices marked * are "Ex div." † Next dividend will be at this rate.